IN THE EYE OF THE BEHOLDER: PERCEPTIONS OF AND REACTIONS TO WILDLIFE AND VECTOR-BORNE DISEASE RISKS

A Thesis

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ABSTRACT

Both scientists and the public are increasingly identifying and reacting to risks associated with wildlife and vector-borne diseases. This trend presents wildlife managers, public health officials, and others (e.g., vector management specialists) with an unprecedented need to communicate effectively about disease risks. Risk communication, described as an exchange of information about the assessment, evaluation, characterization, and management of risk, can help alleviate (a) public misinformation or lack of information about a disease and its associated effects and/or (b) a management entity's lack of understanding of public concerns. For either goal, communication design would benefit from an understanding of how people (individuals or a population aggregately) perceive and react to risks they associate with wildlife disease.

Apprehending risk perceptions and reactions is a complicated process. Leading risk perception theorists generally agree that myriad factors influence individuals' beliefs about and responses to risks. The Social Amplification of Risk Framework (SARF), the most comprehensive explanation of risk perceptions and reactions, suggests that cultural, social, and psychological factors work in concert to affect risk perceptions and reactions. The SARF identifies multiple factors, but is not as useful for explaining *how* perceptions and reactions are affected or identifying the process(es) by which the factors jointly operate.

I studied the ways in which individuals perceived and responded to risks associated with wildlife and vector-borne diseases in an effort to increase understanding of *how* people perceive and react to these risks. Most studies on perceptions of wildlife disease risk have examined the *magnitude of* risk perceptions as opposed to the *reasons for* these perceptions. Knowledge of the *reasons for* risk

perceptions and reactions could explicate the modes of communication about a risk that are best suited to certain audiences.

I conducted case studies in four geographically- and culturally-diverse communities in and around US national parks to investigate perceptions of and reactions to wildlife diseases. Intensive interviews with key informants at each site served as the primary means of data collection (total n = 106). Qualitative analysis of the interview data revealed twenty factors that affected risk perceptions and reactions across cases. Although most of these factors reflected constructs identified previously in risk research as important influences on risk perceptions and reactions, at least three factors were novel: viewing a risk as (a) part of life, (b) ubiquitous, or (c) affecting quality of life independent of the direct effects of the risk object itself (e.g., through a disease vector).

Most factors seemed to have consistent effects across cases on the types and magnitudes of risk perceptions and reactions. I summarize these patterns for each factor and discuss ways in which entities seeking to evaluate risk perceptions and reactions could potentially use this information. I then group the factors based on (a) the degree to which they were context specific versus more broadly applicable, (b) the degree to which they relate to objective constructs versus primarily mental constructs, and (c) whether they are tied principally to community attributes, individual attributes, or some combination of both. I describe how these groupings could facilitate risk communication. Finally, I place each of the identified factors under one of two broad themes: expectations and tangibility. I propose a framework based on these two themes as a parsimonious explanation of how several factors can work in concert to influence the types and magnitude of individuals' risk perceptions and reactions.

BIOGRAPHICAL SKETCH

Darrick Trent (Nighthawk) Evensen was born to the esteemed and enlightened Don and Kathy Evensen on 5 November 1983. He made his home in the small rural (now suburban) village of West Sand Lake, NY, for his first eighteen years. While Darrick grew up exploring the woods around his house and spending many days scouting the fields and gardens of his grandparent's nearby farm, he did not consciously perceive a deep-felt connection to the outdoors until after his adolescent years. Darrick loved West Sand Lake, and considered no other place as close to his heart, yet the juxtaposition of the young man and the sociological context in which he developed produced obvious points of contention. Darrick perceived that his community did not value education, learning, and thought, the ternion closest to Darrick's heart. Additionally, much of the local employment arose from natural resource extraction (e.g., mining and lumber), industries that Darrick viewed as destructive if not also base.

After graduating as valedictorian of Averill Park High School in June 2002, Darrick spent the summer working at a local gas station in his hometown while doing his summer reading for college (The Iliad, The Odyssey, and the Hebrew Bible). The contrariness of Darrick and his childhood surroundings did not strike him until he stepped onto the Princeton University campus in September 2002. At once, Darrick was throttled with massive culture shock and acquired a profound sense of relief. True, Darrick was not the number one student anymore, but he finally had an expansive and diverse community that shared his values and challenged him to think critically. Darrick's definition of home changed from the physical location to the community of thought with which he engaged.

At Princeton, Darrick dabbled in history, politics, religion, and literature before choosing to immerse himself in environmental public policy, with minors in

environmental studies and European cultural studies. In his sophomore year, Darrick conducted his first independent research, examining the actions, motivations, and capacity of local institutions in three nations (USA, Canada, and the Akwesasne Mohawk Nation) dealing with an environmental disaster site in the St. Lawrence River. Since this research in December 2003, Darrick has sought to increase his understanding of why people perceive and value nature as they do. His senior thesis amplified his interest in this topic; the thesis (a) compared environmental ethics in the USA and Sweden and (b) examined some means by which to motivate environmental awareness and behaviors.

During Darrick's academic investigations into how people perceive and value the natural world, Darrick progressed significantly in his reflections on how he himself understood and appreciated nature. For three summers, while at Princeton, Darrick worked as a wilderness guide in the Adirondack Mountains of northern New York State. Following his graduation in June 2006, he took a job with Nature's Classroom, a low paying, but extremely rewarding seasonal position where Darrick worked with middle school students to teach them science, history, and poetry through experiences in the woods, fields, streams, and ponds of New England. In late winter 2007, Darrick flew to Georgia with the intent of walking home on the Appalachian Trail. After close to 1,200 miles, Darrick stepped off the Trail, but his perspective on the natural world was forever altered. Now that Darrick understood himself in relation to nature, he was ready to return to studying how others perceived and valued the natural world.

Just before leaving for the Appalachian Trail, Darrick met with an affable and engaging professor at Cornell University to discuss graduate research. That three-hour discussion with Professor Dan Decker echoed in Darrick's mind as he walked though ice and snow, bogs, wind storms, over mountains, and into dense forests on the Appalachian Trail. At a decrepit computer in an outfitter in a small mountain town in

Virginia, Darrick accepted an invitation to start an M.S./Ph.D. program in Natural Resources at Cornell University in August 2007.

Three years later, Darrick presents his latest foray into studying how people perceive and value nature in the form of this master's thesis. Through his coursework, discussions, and mentoring at Cornell, Darrick has developed substantially in his thinking about the ways in which people behold and appreciate the natural world; as his knowledge has expanded, so have the number of questions he wishes to ask, and his fervency for the topic. Even while growing in his affinity for academic inquiry, Darrick's love for studying how people observe and cherish nature has been overtaken by his love for another person who critically reflects on nature as Darrick does. Darrick and his fellow wilderness guide, Katherine, will be wed in October 2010, fittingly, in the Adirondack Mountains where they worked together. Darrick and Katherine will continue to explore perceptions and valuation of nature in the years to come, both academically and personally.

This thesis is dedicated to those who perceive risks related to wildlife diseases, that they might find relief, and to those who manage these risks, that they might find the wisdom and means to provide at least part of that relief.

ACKNOWLEDGMENTS

This thesis is the result of a truly collaborative effort; individuals from Cornell University and all levels of the National Park Service lent their expertise and guidance to each stage of my research and writing. Additionally, the National Park Service and Cornell University provided substantial financial support to fund this research. Family and friends listened to me for hours upon hours as I pondered over the meanings and potential connections in my qualitative interview data.

I wish first to thank **Dr. Kevin Castle** of the wildlife health program at the National Park Service for lending his expertise and support to every stage of this research. From identification of research questions and project goals, to selection of study sites, to design of research methods, to help with logistics of fieldwork, to review of draft reports, he made this research possible. Over the course of two years working with Kevin, I learned a great deal from this veterinarian with a heart for social science. My only regret is that Kevin and I never were able to conduct research at a National Park Service unit together.

Second, I must recognize the efforts of my minor committee members, **Prof. Rich Stedman** and **Prof. Katherine McComas**, in advancing my knowledge of risk perception and risk communication theory. Through classes, manuscript review, and informal conversations, these two professors fitted me with the background to collect, analyze, interpret, and categorize the data that forms of the backbone of this thesis.

I would be remiss if I failed to acknowledge the time and insight provided by the 106 individuals I interviewed at the study sites in Alaska, California, Michigan, and New York. I thank my interviewees for inviting me into their offices and homes to speak about topics of importance to them and to me. Quotes and ideas from these interviewees comprise my research findings. Without the time and careful thought of these interviewees, this research would never have been able to become more than a

question. I wish particularly to recognize the efforts of NPS employees **Bruce Badzik, Ken Hyde**, and **Steve Yancho**, who went to great lengths to help me identify important interviewees and to understand their respective study sites as best as I could.

Fourth, I direct my attention to **Prof. Dan Decker.** Dan defines my Cornell experience. When I arrived in Ithaca in August 2007, never did I expect an advisor as dedicated, thoughtful, academically engaging, supportive, or amiable as Dan. Dan's encouragement and countless hours discussing emergent ideas with me was no small factor in the final consummation of this thesis. More importantly, Dan is a wonderful colleague who I shall enjoy exchanging ideas with long after these pages are filed away on some dark and dusty shelf.

Finally, my family and friends. My two best mates, **The Specialist** and **The Captain**, helped me through the production of this thesis in very different ways. The Specialist listened intently to my ideas about risk perception formation and helped me to refine these thoughts. The Captain knew when my brain needed a breather and was always there to remind me of the calming peace offered by nature, especially the open water of Cayuga Lake. My fiancée, **Katherine**, and my parents, **Kathy and Don**, listened to my musings about risk perceptions for countless hours, even when I was certainly not making sense. They affirmed the value of my incipient ideas when not even I was sure I understood the connections I was forming. My family and friends allowed me to integrate my work seamlessly with my life, making the whole endeavor not only enjoyable research, but also an important and defining part of who I am.

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Chapter One: Introduction

"It is the safest of times; it is the riskiest of times…. What the Dickens is going on here?"

-- Denton Morrison, quoted in the National Academy of Sciences, *Improving Risk Communication*, 1989.

Risk defines our lives. In our personal lives and our employment, we cannot remove ourselves from the constant discourse about risk and safety. Newspapers, television programming, and the Internet barrage us daily with the effects of risk run rampant in society. Tales of societal risks also provide suggestions for what we, or some other entity, can or should do to limit risk. We cannot go anywhere nor do anything without consciously or subconsciously making some determination about the risks involved. Perhaps the most interesting question related to risk is why people think about and react to risks as they do. We have all encountered instances in which people react differently to the same risk. Likewise, risks that are similar in many ways but differ on a few grounds could elicit completely opposite responses from the same individual.

One genre of risk increasingly in the public and scientific consciousness is risk associated with wildlife and vector-borne diseases (Gortázar et al., 2007). On the most basic level, concern about wildlife disease is increasing because disease outbreaks are occurring and being recorded more often than ever before in modern times, even after controlling for increased monitoring and reporting efforts in recent decades (Jones et al., 2008). A growing human population, global movement of humans and exotic animals, and intensified encroachment on wildlife habitat for agricultural and urban development are principal influences on the expansion in

wildlife and vector-borne disease (Baretto, 2003; Wobeser, 2006). Because these trends will likely accelerate, so too may the incidence of disease. In addition, scientists expect global climate change to facilitate spread of wildlife disease by amplifying vulnerability of potential host populations to infection through increased environmental stress, lengthening the pathogen transmission season, and expanding the geographic ranges of pathogens and vectors (Intl. Assoc. of Fish and Wildlife Agencies, 2005; Kutz et al., 2008).

In the aforementioned social, ecological, and epidemiological realities, I developed my research question for this master's thesis: "What factors affect people's risk perceptions about and subsequent reactions to wildlife and vector-borne diseases?" Inherent in my research question is the assumption that risk perceptions and risk reactions are not dependent on a single factor; rather, I estimate that multiple factors and even multiple categories of factors affect perceptions and reactions. I define risk perceptions as individuals' beliefs about the extent to which (and the means by which) an object or event threatens them personally or threatens something about which they care. Risk reactions can be understood as tangible manifestations of risk perceptions (i.e., actions taken by individuals that stem from their perceptions, such as complaints about a disease, demands for management of a disease, or actions to avoid exposure to a disease).

Studying perceptions of and reactions to risks leads to understanding of how the study population engages with a risk. Engagement includes (a) how one's beliefs differ from "technical assessments" of risk, (b) how one thinks threats should be mitigated, (c) what one personally does to mitigate risk, and (d) which factors condition the formation of one's beliefs and subsequent behaviors. This knowledge could help a risk management entity (e.g., a government agency or other societal institution) identify (a) whether an object or event poses "novel" risks that the entity

had not previously considered, (b) whether (and why) the entity and the study population assign similar or different importance to various risks, and (c) the degree to which the population is well informed about the risk(s). A risk management entity could then use this understanding to communicate better about the risk(s) (e.g., to create messages tailored to specific audiences to clear up misinformation, to design two-way discussions with the public to identify and consider ways of managing "novel" risks, and/or to provide additional information to supplement current understanding of the risk).

In addition to the aforementioned practical implications of investigating risk perceptions and risk reactions, my research question also has potentially interesting theoretical implications. A few extant theoretical frameworks endeavor to identify the comprehensive suite of factors that affect risk perceptions and to detail how these factors shape risk reactions, but these frameworks tend to focus on ultimate, as opposed to proximate factors. Understanding the proximate factors is of utmost importance for risk management. Additionally, the extant theoretical frameworks, while asserting that factors influencing risk perceptions and reactions are connected, do not clearly identify the process(es) by which the factors jointly operate. Identifying the multiplicity of factors that affect perceptions of a given risk and then assessing reactions to those risks could help validate, refine, and/or supplement theoretical frameworks that purport to explain risk perceptions and risk reactions. In asking my research question, I sought to use real spatially- and temporally-located risks to evaluate the ability of current frameworks to predict factors affecting risk perceptions and reactions.

Similar to the rationales for studying risk perceptions and risk reactions, I selected wildlife and vector-borne diseases as the focus of my research due to potential opportunities to contribute to real, on the ground, risk management as well as to

advance the research literature. A budding area of inquiry focuses on risk perceptions regarding wildlife and vector-borne diseases, but most research attends to the *level* of risk individuals perceive to be associated with diseases, and not the *factors* affecting perceptions and reactions. Not only does this research trend reveal a gap in literature, it also demonstrates a problem for risk management entities seeking to communicate about wildlife disease risks. Without knowing the full complement of factors (or, realistically, at least most of the factors) that condition risk perceptions and risk reactions, a management entity cannot discern which messages to communicate to which audiences.

The National Park Service's (NPS's) Wildlife Health Team, an entity that manages and communicates about wildlife and vector-borne diseases and their associated risks, identified the aforementioned information need. The Wildlife Health Team was interested in funding and collaborating on a research project that compared risk perceptions and risk reactions across diseases and situational contexts because this research could have management implications for NPS units as well as at the system-wide level.

In management and communication, the NPS seeks to account for and respond to concerns uncovered via technical assessments and through analysis of public perceptions of and reactions to risks. Perceptions and reactions may be based on concerns for which technical assessments are unable to account (e.g., aesthetic, economic, or culturally specific concerns), or they may proceed from a lack of information or misinformation about a disease. Public and employee risk perceptions that proceed from a lack of information or misinformation could negatively affect relationships with an NPS unit if the unit does not seek to clarify the situation. Risk perceptions and reactions that proceed from an NPS unit's inadequate understanding of public concerns could negatively affect relationships with an NPS unit if the unit

does not seek to identify and respond to those concerns. Through this study, the NPS and I sought to collect and analyze information that could help identify opportunities for communication with the public and inform messages about wildlife and vector-borne disease risks.

One objective of my research was to identify factors that contribute to variation in perceptions of and reactions to wildlife and vector-borne diseases across social, cultural, environmental/geographic, and epidemiological contexts. Risk management entities could benefit by gaining understanding of how the varying contexts affect risk perceptions and reactions. By knowing which factors affect perceptions and reactions and in which ways, managers would gain awareness of specific audiences that could benefit from particular messages.

Thesis Outline

In the next chapter, I address two questions: "why risk perceptions and risk reactions" and "why wildlife and vector-borne diseases." I discuss (a) how delving into the research question could support, refine, or supplement frameworks that explain risk perceptions and risk reactions, and (b) how the proposed inquiry could generate information useful to management entities dealing with wildlife disease risks. To accomplish this, I review (a) theories and theoretical frameworks that explain the determinants of risk perceptions and reactions and (b) the status of empirical research on risk perceptions about wildlife and vector-borne diseases.

In chapter three, I discuss my research methods and the rationale for selecting those methods. Chapter four contains detailed descriptions of the four study sites (NPS units and surrounding communities). Most of the information in this chapter arose from data collected during my fieldwork, making chapter four the first of two findings chapters.

Chapter five, the second findings chapter, presents, describes, and categorizes the data I collected during 106 intensive interviews at the four study sites. I consider the theoretical implications of my findings and offer an emergent framework for explaining how individuals perceive risks associated with wildlife and vector-borne diseases in chapter six. Chapter seven explains how the findings reported in chapter five and the framework identified in chapter six could be of practical use to risk managers. I conclude with reflections on my master's thesis research and its implications for future study in chapter eight.

Chapter Two: Risk Perception Theory and Empirical Research

"*Dubium sapientiae initium.* (Doubt is the origin of wisdom.)

-- Rene Descartes (1596-1650), *Meditations on First Philosophy*, 1641

This chapter is broken into two primary sections: (a) a discussion of the dominant factors affecting formation of risk perceptions and risk reactions according to current theory, and (b) a review of recent studies and general trends in empirical research on perceptions of risks associated with wildlife and vector-borne diseases. By illustrating the factors that have been identified as important contributions to risk perceptions and risk reactions, the first section identifies the types of factors that could likely emerge from my data collection. The second section reveals that many factors that supposedly affect risk perceptions (as highlighted in the first section) have received little attention in reference to their effects on risk perceptions about wildlife diseases. This points to a knowledge gap in the literature on wildlife and vector-borne disease risks and accents the potential managerial implications of my research question.

Current Trends in Risk Perception Theory

Researchers and theorists who engage the question of how people perceive and react to risks widely agree that multiple factors affect risk perceptions and risk reactions. Many leaders in the field of risk analysis assert that no single approach to analyzing beliefs about and reactions to risks (e.g., psychological, social, or cultural theories of risk) can individually provide a sufficient explanation for formation of risk perceptions and reactions (Kasperson et al., 2003; Kasperson et al., 1988; Krimsky & Golding, 1992; Pidgeon et al., 2003). Renn (1992, 1998) makes clear the limitations

of using any single theory for understanding risk perceptions and advocates integrating perspectives to generate a more inclusive explanation of public risk perceptions.

Leading theorists contend that factors affecting risk perceptions and reactions are interrelated (Kasperson et al., 2003; Pidgeon et al., 2003). One type of influence can affect a person's perceptions and reactions to differing degrees based on the role played by other influences. Some researchers have actively combined tenets from various theories to create comprehensive frameworks that synthesize many major factors affecting risk perceptions and reactions. The Social Amplification of Risk Framework (SARF) is the most commonly cited "comprehensive" framework. The SARF draws on aspects of cultural/social theories of risk and psychological theories of risk. Other risk perception researchers affirm that (a) cultural/social theories, (b) psychological theories, and (c) interdisciplinary approaches that combine these theories are the major perspectives needed to explain risk perceptions comprehensively (Lavino & Neumann, 2010; Krimsky & Golding, 1992). The remainder of this section contains descriptions of the diverse factors affecting risk perceptions that populate these three leading perspectives.

Cultural/Social Theories of Risk

Numerous "cultural" and "social" factors have been cited as influencing individuals' risk perceptions and reactions. While a review of cultural and social theories of risk does not provide a clear line that separates *culture* and *society* (these two constructs are obviously interrelated), it is useful to think of cultural *factors* and social factors as *two* categories of influences that affect risk perceptions and reactions. Cultural factors fall into the realm of values, beliefs, traditions, and norms. Social factors consist broadly of institutions and their actions, community characteristics (the community may be spatially-located or a community of interest), and interactions occurring within the community. Cultural and social factors affect risk perceptions by

conditioning people to notice and value certain interactions, relationships, and objects. A person with one cultural or social background may perceive a threat where someone of a different background would not.

One of the earliest assertions that cultural and social factors were paramount in explaining perceptions of and reactions to risks was the "cultural theory of risk," which states that perception of risk is a social process and that evaluation of acceptability of risks does not make sense without considering the social aspects of risk (Douglas & Wildavsky, 1982). Cultural theory seeks to use a group's way of life to explain why one group of people, on the aggregate level, may pay attention to a given hazard when other groups do not acknowledge it as posing risks. It is important to note that social/cultural theories of risk generally identify the individual as the level on which risk perceptions form. Cultural theory, and other theories such as the contagion theory of risk perception (based on social networks), assert that individuals perceive risks, but that "relational aspects of individuals and the resulting networks and self-organizing systems influence individual perceptions and build 'groups or communities of like-minded' individuals" (Scherer & Cho, 2003, p. 261). The members of these groups often form comparable risk perceptions based on their similar social situation.

Douglas and Wildavsky (1982) assert that the organization of society and communities, including the institutions present therein, shapes how people perceive risks. Proponents of a cultural theory of risk assert that distribution of power and control fundamentally structures culture and society, and thus affects the risks to which an individual reacts. This theory asserts that perception and characterization of risk is a political act that functions to express and reinforce identities. For example, people may define and react to risks based not only on their beliefs about the risk, but also on their beliefs about how societal norms dictate they should think about it.

Cultural theory posits that hierarchy and solidarity, or "grid and group" as Douglas and Wildavsky (1982) term it, are imperative organizing components of culture. According to this theory, grid and group are the primary factors that explain risk perceptions. Douglas and Wildavsky (1982) offer a matrix of four prototypical cultural biases that can be applied to communities, based on whether the community has a high or low level of grid and group. The cultural bias that characterizes a community should be able to explain that community's risk perceptions and reactions. For example, an egalitarian and self-sufficient community will respond differently to risks than a hierarchical collectivistic community. The latter community would predictably have greater capacity to respond to the risk.

Sjöberg (2000) questions the explanatory power of these prototypical cultural biases when he reports that multiple quantitative studies of cultural theory have shown that cultural biases stemming from grid and group only explain 5-10% of variance in risk perceptions, on average. Dake's (1992) survey items, developed to measure cultural biases, formed the basis for the studies that Sjöberg assessed. Rippl (2002), however, shows that Dake's survey items violate the measurement theory associated with cultural theory by failing to demonstrate correlations between the various cultural biases where cultural theory predicts they exist. Thus, quantitative measurements based on Dake's survey items may not paint a reliable picture of the ability of grid and group to explain risk perceptions. Nevertheless, even after Rippl (2002) constructed more valid measures that addressed the issue of nonconformity of correlations between cultural bias measures, this was not found to increase the power of cultural biases associated with grid and group for explaining risk perceptions. Therefore, while cultural theory offers grid and group as two factors that demonstrably affect risk perceptions, it appears that these two factors explain little variance, suggesting that other factors are necessary to explain risk perceptions and reactions.

Psychological Theories of Risk

Psychological theories of risk represent the other main category of factors that explains development of risk perceptions and reactions. Psychological theories of risk attempt to explain the types and magnitudes of risks individuals perceive through the thought-processing and decision-making mechanisms upon which people rely. These theories focus primarily on three sub-categories of factors to describe development of risk perceptions: (1) risk characteristics, (2) reliance on cognitive and/or affective processing, and (3) activation of heuristics.

Risk characteristics.

While cultural/social theories contend that characteristics of the social and cultural content are paramount in conditioning risk perceptions, psychological theories of risk perception place far greater weight on risk characteristics as the major influences on risk perceptions and reactions. An individual may perceive and react to risks based on characteristics he or she associates with risk objects and/or risk events. A risk object is the tangible entity that causes or leads to the presence of the threat. For example, a risk object could be a disease, or even the vector transmitting the disease, that might make one ill. "Risk event" describes the emergence and recognition of a risk. For example, a risk event could be a county health department reporting that it found West Nile Virus in mosquitoes in one's town.

Characteristics of the risk object and risk event fall under psychological theories of risk because researchers have found that certain characteristics have predictable effects on the ways in which individuals perceive risks. The typical psychometric dimensions on which risks are evaluated, such as "knowledge and dread," include many risk characteristics shown to affect risk perceptions such as whether the risk is observable, whether the effects of the risk are immediate or

delayed, whether the risk has catastrophic potential, and whether the risk has fatal consequences (Slovic, 1987; Slovic, 1992).

Several risk characteristics not included in "knowledge and dread" also could affect how and why people develop risk perceptions; these include spatial proximity of the risk, prevalence of the risk, who or what the risk affects, and visibility of not only the risk, but also its effects (Klinke & Renn, 2002). Klinke and Renn also identify the manner in which the risk affects humans and things humans care about (including whether there is any remedy/treatment for the risk's effects) and the severity of the risk's effects as important risk characteristics. The physical and biological components of the landscape might also play a role in affecting risk perceptions. For example, diseases thrive in certain physical environs and sustain a more limited presence in less favorable environments.

Reliance on cognitive and/or affective processing.

The degree to which individuals use cognitive and/or affective processing to interpret perceived characteristics of a risk can affect risk perceptions (Keller et al., 2006, Loewenstein et al., 2001; Slovic et al., 2004; Slovic & Peters, 2006;). Cognitive processing of risk characteristics "uses algorithms and normative rules, such as probability calculus, formal logic, and risk assessment" to evaluate risks (Slovic et al., 2004, p. 311). Affective processing "is intuitive, fast, mostly automatic, and not very accessible to conscious awareness" (Slovic et al., 2004, p. 311).

Theories on affect and cognition fit into three main categories: theories postulating affective primacy, theories asserting cognitive primacy, and linkage theories that view cognitive and affective processes as working in concert, without claiming that either precedes the other (Neuman et al., 2007). Linkage theory, has garnered considerable attention in the field of risk perception, with particular focus on

dual-processing models, a form of linkage theory (Keller et al., 2006; Loewenstein et al., 2001; Slovic et al., 2004; Slovic & Peters, 2006).

By definition, dual-processing models separate thought processing into two categories, each operated by different neural systems – controlled (cognitive) processing and automatic (affective) processing (Deutsch & Gerard, 1955). Risk analysis researchers generally view thought processing as a continuum that extends from purely affective processing to solely cognitive processing; each decision-making process falls somewhere on that continuum (Loewenstein et al., 2001; Slovic & Peters, 2006; Spezio & Adolfs, 2007).

The degree of affective and cognitive processing on which an individual relies can affect the magnitude and types of risks that he perceives. For example, the magnitude and type of affective processing can be influenced by vividness (e.g., perceived severity) and spatial or temporal proximity to a risk (immediacy) (Loewenstein et al., 2001). Vivid and immediate risks may generate powerful emotions and foster affective processing that makes a risk more tangible (Sherman et al., 2002).

To argue that vividness and immediacy can condition an individual's degree of affective processing assumes that an individual first perceives characteristics associated with a risk object or risk event that can be vivid or immediate. This, however, does not occur in a social and cultural vacuum. The developing field of cultural cognition proposes a revision to dual-processing models by asserting that values and worldviews not only affect the risk characteristics that people perceive; they may also affect the level of cognitive or affective processing directed toward those risk characteristics (Kahan et al., 2009).

The cultural cognition hypothesis suggests that culture may influence the degree of cognitive and affective processing irrespective of any risk characteristics;

that is, culture may predispose an individual to think cognitively about certain types of risks and to think affectively about other types of risks. Thus, cultural cognition builds a bridge between cultural/social and psychological theories of risk; in this way, the cultural cognition hypothesis is similar to the proposition that affective processing can function as a heuristic (Slovic et al., 2004).

Activation of heuristics.

Heuristics were one of the first categories of factors postulated to affect risk perceptions and reactions (Tversky & Kahneman, 1974). Heuristics are cognitive shortcuts that individuals subconsciously use to reduce the amount of mental effort required to make decisions. Cultural factors can substantially affect (a) whether or not members of a community tend to rely on heuristics, versus systematic processing, with respect to a certain risk and (b) the types of heuristics that are most salient to individuals with respect to a certain risk.

Heuristics exist prior to and, for the most part, independent of a particular emergent risk. Individuals can activate a heuristic only if they develop the heuristic before a risk event emerges. Activation of heuristics leads to a reaction similar to a defense mechanism – a stimulus immediately prompts a particular response or reaction (Gilovich et al., 2002). Activation of heuristics well suited to a particular risk can dramatically increase efficiency in decision-making about the risk (Tversky & Kahneman, 1974). Heuristics that were developed based on interaction with similar, but not identical risks may lead to misinformation or misconceptions about a risk.

Heuristics and cultural cognition illustrate how cultural, social, and psychological factors can operate in concert to condition risk perceptions and reactions. This point is established clearly in the Social Amplification of Risk Framework.

The Social Amplification of Risk Framework

The Social Amplification of Risk Framework (SARF) is perhaps the most widely recognized and most comprehensive theoretical framework that seeks to combine multiple perspectives on how individuals perceive and react to risks. The SARF builds from the premise that psychological, social, *and* cultural factors are necessary to explain risk perceptions and reactions. Psychological factors cannot explain why risk perceptions and reactions differ substantially from one community to another with reference to the exact same hazard (Baxter, 2009). Social factors cannot explain intense variation in risk perceptions within a community. Cultural factors, at least based on current measurements, can only account for a small percentage of total variance in risk perceptions. Taken together, however, these factors yield a more holistic understanding of risk perceptions and reactions, which is the SARF's goal.

Proposed in 1988, the SARF has undergone several iterations (Kasperson et al., 2003). The SARF "arose out of an attempt to overcome the fragmented nature of risk perception and risk communication research by developing an integrative theoretical framework capable of accounting for findings from a wide range of studies" (Kasperson et al., 2003, p. 13). This framework brings together factors contained within psychological and cultural/social theories of risk as well as tenets from mass media research and other aspects of communication theory.

The SARF was designed to illuminate the factors that lead to societal amplification or attenuation of risk perceptions and reactions (Pidgeon et al., 2003; Kasperson et al., 1988). To achieve its purposes, the SARF posits interactions between numerous factors that potentially affect perceptions and reactions. Because the SARF postulates feedback pathways between each and every factor, the framework is more of an illustration of the *types* of factors that can influence risk perceptions and reactions than a description of *how* these factors result in particular

beliefs and behaviors. The factors the SARF includes as influencing risk perceptions and reactions are too numerous to list, but Kasperson et al. (2003) separate the factors into five broad categories: sources of information, information channels, social groups and organizations, individual beliefs and modes of thought processing, and institutional and social behavior. These five categories reflect psychological (e.g., 'individual beliefs and modes of thought processing'), social (e.g., components of 'social groups and organizations'), and cultural factors (e.g., some factors within 'institutional and social behavior'). Each category and some factors combine tenets of psychological and social/cultural theories of risk.

The diagrammatic representation of the SARF depicts a mostly a recursive model; however, the framework suggests that risk perceptions and reactions do have a starting point – development of beliefs and subsequent responses begins with human recognition of and communication about a "risk event" (Kasperson et al., 2003). Kasperson et al. define "risk event" as any actual or hypothesized threat that people acknowledge, whether through direct experience, casual conversation, formal study, the mass media, or some other means. After humans recognize the presence of a risk event, "a wide range of psychological, social, institutional, or cultural processes" condition perceptions of and reactions to the hazards associated with that risk event (Kasperson et al., 2003, p. 15).

A great virtue of the SARF is that it brings together several constructs to create a comprehensive list of factors that affect risk perceptions and reactions. The inclusiveness of the SARF (at combining cultural, social, and psychological factors as well as speaking to risk perceptions *and* reactions) is unparalleled by other risk frameworks. While risk researchers generally acknowledge that many categories of factors are needed to understand fully people's perceptions of and reactions to risks, the SARF has been critiqued on several fronts.

First, some researchers have criticized the SARF for attempting to reconcile theories of risk that they believe ought to be kept separate (Murdock et al., 2003). This critique would be fair if the SARF's authors sought, for example, to use their framework to reconcile cultural theory and psychometric theory. These theories are indeed strange bedfellows, as the psychometric theory asserts that risks have objective attributes and considers risk perception and reaction to be processes that occur on the individual level. Cultural theory views risk attributes as socially/culturally constructed and views cultural power dynamics as substantially shaping individual decisions. The SARF, however, does not seek to combine theories, it only efforts to combine factors. If cultural factors and psychometric factors have been shown empirically to affect risk perceptions and reactions separately, then it seems logical that they may both affect beliefs about and responses to the same risk. Unfortunately, little research has sought to validate the SARF's comprehensiveness, making this claim tentative.

An issue that confounds resolution of the previous critique is that the SARF is not easily tested (Pidgeon et al. 2003). This second critique includes the point that the framework provides no clear guidelines for how to operationalize the constructs contained therein. A third critique is the SARF's focus on a risk event as the starting point for a construction of risk perceptions and reactions. While Kasperson (1992) observes the importance of historical and cultural perspectives in conditioning how a person will perceive and react to risks before any particular risk emerges, the SARF's definition of the risk event as the starting point for risk perceptions and reactions restricts the influence of cultural and social factors to values and institutions related to a specific emergent risk. This limits their relevance in shaping the context in which the risk emerges.

A final concern is that the SARF undervalues the role of the public in shaping their own risk perceptions and reactions (Horlick-Jones et al., 2003; Murdock et al.,

2003). These researchers argue, in accordance with Beck's (1999) conception of the World Risk Society, that in the modern age, the public is increasingly developing its capacity for and propensity to engage in critical reflection on societal risks. They contend that the SARF depicts individuals primarily as passive receivers of information whose risk perceptions and reactions are largely formed by the societal institutions communicating about and framing those risks. Thus, some scholars think that the SARF, while fusing cultural, social, and psychological factors, may downplay the relative importance of some psychological factors (e.g., thought processing). Because Kasperson et al. (2003, 1988) do not fully explain or operationalize the factors in the SARF that fall under 'individual beliefs and modes of thought processing,' it is difficult to evaluate the legitimacy of this critique.

Synthesis.

Experts in risk analysis widely agree that to explain risk perceptions holistically, one must rely on multiple factors. Cultural, social, and psychological factors are the three broad types of influences most commonly identified as affecting risk perceptions and reactions. The SARF has drawn together numerous factors to produce a comprehensive explanation of how people perceive and react to risks. While this framework identifies many essential factors and reveals some important relationships between factors, critiques intimate that it may be difficult to directly validate or refute the framework's claims. These critiques also depict the SARF as an evolving idea that may be open to revision. Because the SARF comes closer to explaining risk perceptions and reactions than any other framework in the field of risk analysis, I used it to help form the ontological basis for my research question. Because the SARF is not easily tested and contains questionable assumptions about the relative importance of certain factors, I only relied on it loosely in designing my research.

The foregoing discussion of theory about risk perceptions and reactions suggests that my study could contribute to risk research by lending support to or suggesting revisions to the SARF. The ways in which people perceive and react to risks is no trivial matter for individuals and entities responsible for managing risks. In the next section, I discuss how the focus of empirical research on perceptions of and reactions to wildlife disease risks creates an opportunity to study risk perceptions and reactions in a field where managers could truly benefit from increased knowledge.

Empirical Research on Perceptions of Wildlife Disease Risks

Research has only scratched the surface of people's concerns about wildlife and vector-borne disease. The earliest peer-reviewed journal article on this topic returned by multiple search engines was a 1997 article on risk perceptions about Lyme disease (Shadick et al.). Since then, approximately two dozen articles have discussed perceived risks related to wildlife diseases. A meta-analysis of social science research on wildlife diseases by Vaske et al. (2009) reveals the paucity of research that has been conducted on most wildlife diseases. Vaske and colleagues recognize that there are several potential consequences of wildlife diseases, and that the available research has not been comprehensive in assessing the variety of effects a disease can have. Elsewhere, Vaske (2010, p. 176) explains,

> Most [social science] research on wildlife disease can be characterized as one shot cross-sectional studies that are applied in focus. … a systematic and theory-based program of [social science] wildlife disease research is needed to address the range of potential human and wildlife impacts.

Research on risk perceptions associated with wildlife diseases falls largely into one of two categories: (1) research that measures risk perceptions by quantifying the level of perceived risk and (2) research that identifies particularly salient factors that affect how and why people perceive risks. The second category includes some

research that quantifies the magnitude of perceived risk as well. Research of the first type (e.g., Gstraunthaler & Day, 2008; Peltz et al., 2007; Shadick et al., 1997; Vaske et al., 2004; Wilson et al., 2005) answers neither the theoretical question of how risk perceptions form nor the pragmatic question of how to best tailor communication to respond to perceptions of wildlife disease risks.

Peltz et al. (2007) present a study that compares risk perceptions about an outbreak of avian influenza in Israel across two populations. The researchers measured risk perception by asking respondents to report the extent to which they felt fear, indifference, stress, and hope about the avian influenza outbreak. They found that respondents in the area in which the outbreak occurred had significantly lower levels of fear and stress, suggesting a "need [for authorities] to direct their effort to disseminate selective, relevant, timely necessary information to selective populations in the country, in order to reduce unnecessary distress and unwanted behavior, which might be different in different parts of the same country" (Peltz et al., 2007, p. 549). The authors explain how their research identified an audience potentially in need of communication, but because the research did not investigate which factors affected risk perceptions, there is little understanding of why people were concerned, leaving a deficit in information important for constructing effective messages.

The second category of studies (e.g., Brook & McLachlan, 2006; Brunet & Houbaert, 2007; Dorn & Mertig, 2005; Zielinski-Gutierrez & Hayden, 2006) has potential to contribute more substantially to risk perception theory and help managers create potentially useful messages. These studies employed methods such as focus group interviews, participant observations, semi-structured interviews, and other qualitative methodologies to identify the factors that affect individuals' risk perceptions about wildlife diseases.

Zielinski-Gutierrez and Hayden (2006) detail a study that compared risk perceptions about West Nile Virus (WNV) in two locations in Colorado. This work used focus-group interviews in areas of high and low disease transmission to develop a model for how community members established perceptions of WNV risk. Coding of the qualitative data revealed that several factors contributed to risk perceptions, including (a) perceptions of transmission probability, (b) understanding of local ecology, (c) characteristics facilitating risk emergence, (d) actions of local government, and (e) cultural influences such as information sources. These findings led the authors to: (a) identify aspects of local ecology on which to focus agency communication, (b) identify specific segments of the public to target agency risk communication toward, and (c) provide suggestions for proactive stakeholder involvement in areas where the disease is not yet present.

While potentially more useful for theory and management, research in the second category of studies is limited. The majority of risk perception analyses with respect to wildlife disease have focused on the *level of concern* that certain segments of the public have for single diseases. A minority of studies have examined the *types* of risks individuals perceive or the *factors* that condition those perceptions. While some studies have shed light on characteristics of a disease or a particular social context that affect risk perceptions, I have not located any research that examines multiple diseases in numerous contexts. Such research could reveal which factors affecting risk perceptions and reactions have potential to transcend social, cultural, environmental/geographic, or epidemiological contexts.

Because a handful of wildlife diseases have received the majority of research attention (e.g. Chronic Wasting Disease [CWD]), little is known about the types or magnitudes of risk perceptions that exist for most diseases or the factors that contributed to development of these perceptions. Research on CWD, however, has

provided some enlightenment: (a) myriad factors affect risk perceptions and reactions and (b) the SARF was able to predict some but not all major factors.

Reviews of several years of CWD research by Heberlein and Stedman (2009) and Vaske (2010) reveal that perceptions of *risk characteristics* played an important role in conditioning risk perceptions and reactions; individuals perceived CWD as new, involuntary, potentially catastrophic, and uncontrollable. *Social factors* such as the nature of media coverage, a lack of available efficacy information, and institutional management of CWD also affected risk perceptions and reactions. *Additional factors* including values, beliefs about disease ecology, length of experience with the risk, and trust in management entities also played a role. Psychological, cultural, and social factors were indentified as important in conditioning risk perceptions and reactions. Most of the reviewed research, however, focused specifically on the hunting community and many studies limited their cultural/locational context to Wisconsin. Research on CWD supports multiple aspects of the SARF but also suggests that the framework could be expanded to include the aforementioned "additional factors." Research on novel wildlife diseases in diverse contexts may help to validate the relevance of the CWD factors in broadly explaining risk perceptions and reactions.

In addition to historical studies, some experimental research has examined how characteristics of wildlife diseases influence risk perceptions (Needham et al., 2007; Peterson et al., 2006); these studies relied on hypothetical diseases. Studying hypothetical diseases assumes the dominance of disease/risk characteristics in conditioning risk perceptions. While helpful in identifying some factors that could potentially apply to several wildlife disease risks, the CWD research reveals that studying risk characteristics only tells a piece of the story. Because characteristics of the cultural milieu and societal response to a disease also condition risk perceptions

and reactions, research must examine real diseases in real cultural, social, environmental/geographic, and epidemiological contexts. Only in these situations can a researcher hope to gather data on most of the major factors that affect risk perceptions and reactions.

Research on wildlife disease has focused on concerns ranging from human, domestic animal, and wildlife health to effects of a disease on the local economy (Vaske et al., 2009), but only a few studies examine more than one reason for concern about a disease (for a good example of one, see Dorn & Mertig, 2005). Most risk perception studies have been limited to studying concerns related to human health, and do not address the possibility that people may have other salient concerns about the effects of a wildlife disease (e.g., Figuié & Fournier, 2008; Shadick et al., 1997; Wilson et al., 2005). People may have concerns about wildlife diseases that no study to date has examined (e.g., ecosystem health, aesthetic considerations).

The exciting findings related to CWD (and the dearth of information about types of risk perceptions/reactions and factors affecting perceptions/reactions for nearly every other wildlife disease) led me to study multiple diseases in multiple contexts. My review of the literature also revealed that the studies that best identified a complement of factors did not start with preconceived notions of what the factors were, but engaged in exploratory research. Most employed qualitative methods. Indeed, the CWD research revealed that even the most comprehensive framework to explain risk perceptions and reactions, the SARF, could not offer a relatively complete understanding of perceptions of and reactions to CWD.

Conclusion

Leading experts in the field of risk analysis accentuate the need to use multiple categories of factors (e.g., psychological, cultural, and social) to explain holistically how individuals perceive and react to risks. Because few studies that focus on wildlife

disease risks have examined anywhere near the range of factors that leading theories define as essential to understanding risk perceptions, little is known about *how* people perceive wildlife disease risks (as opposed to *how much* risk people perceive). Investigating factors that affect risk perceptions about and reactions to wildlife diseases could (a) help validate, refine, and/or supplement the SARF and (b) fill a knowledge gap in the literature on risk perceptions and reactions associated with wildlife disease. Both of these steps could improve the ability of individuals and agencies to manage wildlife disease risks through communication.

Too little research exists for me to construct a defensible hypothesis about the suite of factors that affect risk perceptions about and reactions to wildlife diseases. Therefore, consistent with a few other researchers cited herein, I chose qualitative methods to *explore* the multiplicity of factors that might affect risk perceptions and reactions. I describe my methods in detail in chapter three.

Chapter Three: Methodology and Methods

"Three things are to be looked to in a building: that it stand on the right spot; that it be securely founded; that it be properly executed."

-- Johann Wolfgang von Goethe (1749-1832), *Elective Affinities*

In this chapter, I (a) discuss the *methods* used to collect data, (b) explain my *methodology* (i.e., the justification/rationale for selecting these research methods), and (c) illustrate my research *design* (i.e., how I employed these methods when in the field and during subsequent data analysis).

Methodology

I used a multi-case study approach to research risk perceptions about and reactions to wildlife diseases, collecting data in and around four geographically, socially, and culturally diverse NPS units (I discuss each study site in depth in the following chapter). The case – the unit of analysis in this investigation – was the population living and working in and around an NPS unit; thus, this study contains four cases. One may question selection of a population versus an individual as the appropriate unit of analysis. While the risk perception literature reviewed in chapter two indicates that individuals, not collectives, perceive and react to risks, this same literature clearly points to the relevance of social, cultural, and environmental/geographic context in conditioning perceptions and reactions.

Using individuals as the unit of analysis would generate an understanding of how risk perceptions vary from person to person. Selecting populations as the unit of analysis would identify factors that shape the perceptions of a population on the aggregate level. Because I was working with the National Park Service, we sought to identify factors affecting risk perceptions and reactions that could inform policy and/or

communication on a park unit level. Thus, it made greater sense to consider the population in and around the NPS unit, compared to the individual, as the case (i.e., the unit of analysis). Even when gathering and analyzing data from individuals (e.g., from my interviews), I primarily collected and evaluated comments related to the case, not the individual.

Case studies best allow the researcher to form a holistic picture of how an event (or series of events) unfolded in a situation where the phenomena being studied cannot be extracted from the context (Yin, 2009). Yin (2009) also explains that case studies are most advantageously employed, compared to other methods, when the researcher is asking "how" or "why" questions in a contemporary real-life setting. I wanted to know how (the processes by which) and why (the motivating factors by which) individuals in the four populations thought about and responded to risks as they did. This understanding could lend increased clarity to theoretical frameworks that explain risk perceptions and reactions. Indeed, in acknowledging a shortcoming of the SARF, Pidgeon et al. (2003, p. 4) state, "For risk communication policy [there is], above all, a need to explore the context (and the history) of events, trying to understand the key actors or issues…*in the particular case at hand*" (emphasis original). The multi-case study research could also fill a gap in the empirical literature on wildlife and vector-borne diseases, because little research has examined the role of context in conditioning risk perceptions or reactions (Decker et al., 2010).

Research Design

A qualitative approach guided data collection. I sought primarily to understand the *nature of concerns* about and reactions to wildlife disease, more so than to estimate the *frequency* with which certain concerns were held or reactions took place. Intensive interviews were my primary means for data collection, supplemented by reviews of local mass media coverage and informal interviews.

The case studies were designed with an exploratory approach to data collection and analysis. While the SARF provides the most comprehensive explanation for how and why individuals perceive risks, chapter two suggests that some studies give us reason to believe that the framework is incomplete. Therefore, rather than attempting to use the SARF's theoretical propositions as a starting point, I chose to allow important factors affecting risk perceptions and reactions to emerge. This would provide for potential confirmation of aspects of the SARF, but would not also limit the factors identified in the data to those in the existing framework. The relatively incipient status of research that seeks to explain how and why people perceive risks associated with wildlife diseases also supports an exploratory approach.

Having selected an exploratory approach to multi-case study research, grounded theory provided a second guiding framework for my data collection and analysis (Glaser & Strauss, 1967). This research method encourages the generation, as opposed to the confirmation, of theory. A premise of grounded theory is that constant comparison of rich data from different individuals within a case, and across cases, will allow themes that address the research question to emerge. While I had interest in seeing which aspects of the SARF my research would support, my reluctance to apply the SARF to my research (due to the critiques shared in chapter two) led me to accept grounded theory as a design framework for my research. Under my grounded theory, if the SARF were a complete description of risk perceptions and reactions, a comparison of my eventual findings to it would yield an identical match. If a comparison of my findings with the SARF revealed differences, this could suggest ways to refine and/or supplement the SARF.

Methods[1]

This research was conducted in collaboration with wildlife health professionals from the National Park Service's (NPS's) Biological Resources Management Division. The methods discussed in this chapter were selected in consultation with the NPS Wildlife Health Team.

Within the realm of qualitative methodologies, I selected intensive interviews to collect the majority of my data. Contrasted with structured interviews, intensive interviews focus on gathering information from free-flowing conversations as well as from open-ended questions that do not direct the interviewee to a certain set of response possibilities (Lofland et al., 2006). I determined that this type of questioning could facilitate best the *emergence* of factors affecting risk perceptions because it does not limit or restrict interviewees' responses to predetermined questions or topics. Because intensive interviews rely on interviewee responses to an initial question to direct future questions, they allow interviewees to share their own beliefs about a topic (e.g., risk perceptions about a disease) with minimal influence from the interviewer. I employed a particular genre of intensive interviewing—oral histories. Oral history interviewing seeks to capture how a person's experiences situate him or her to provide a unique perspective on a specific event or series of events (Ritchie, 2003).

Consistent with the method of intensive interviews, and particularly oral histories, I did not bring an interview instrument to my interviews. In this type of interviewing, the responses to an initial one or two questions set the tone for the follow-up questions for the remainder of the conversation. Even the initial question did not remain static across interviews; I changed my initial questions to reflect the interviewee's unique position and experiences. I was able to tailor these preliminary questions based on archival (primarily Internet-based) research about the individual

[1] This research received approval from the Cornell University Institutional Review Board for Human Participants, Protocol ID#: 0909000122.

(and his or her organizational affiliations) and on background information I obtained from each interviewee when scheduling the interview with him or her on the telephone.

Oral histories do not lack structure completely. I identified and compiled topics of potential interest ahead of each interview. The theories and frameworks identified in the previous section, particularly the SARF, helped generate topics of interest. When the natural flow of the conversation led to these topics, I probed further. It must be noted, however, that while attention to the SARF certainly directed the concepts I asked about in *follow-up questions*, no idea from a theoretical framework was used to guide an interviewee to a certain response.

Before visiting the study sites to conduct fieldwork, I performed archival research to generate a background profile for each case; these contained knowledge that would help me ask informed probes while interviewing. The profiles included (a) basic demographic data on the population surrounding the parks, (b) reviews of local newspaper articles on the diseases of interest, and (c) information on the activities of other organizations and agencies involved in managing the risks associated with the disease.

For the reviews of local media sources, I searched the most commonly read newspapers in the communities surrounding each NPS unit for articles on the disease(s) of interest at each site. Knowing the types of risks the newspapers focused on, and the ways in which the newspapers framed these issues, provided background information that helped me to probe the interviewees. I examined newspapers for the degree to which they framed risks in terms of the scientific background on the subject versus narratives. I also inspected articles for the quantity and quality of efficacy information the newspapers provided about the relevant disease(s).

Case selection.

After consultation with the NPS's Wildlife Health Team, I worked with officials from all seven NPS regional offices to identify NPS units in each region that might fit into the study. I sought units with (a) at least fifteen employees (the target number of employees I intended to interview in each unit), (b) at least one local community with which the NPS unit had an identifiable relationship, and (c) at least one wildlife or vector-borne disease issue that attracted considerable public attention recently. Because I sought to compare risk perceptions across diseases and contexts, I tried to identify NPS units in different cultural, social, and environmental/geographic contexts and with different concerns. Conversations with the regional officials generated a list of sixteen units from six regions that I then individually contacted (the National Capital Region suggested not using any of its units in the study).

I spoke with chiefs of natural resources, biologists, and/or cultural anthropologists at the sixteen units. From these NPS officials, I learned as much as I could about (a) the disease(s) at each NPS unit, (b) the unit employees and the public's perceptions of and reactions to the risks, (c) how the local context potentially affected risk perceptions and reactions, (d) the societal response to perceived risks associated with the disease(s), and (e) the unit's interest in being a study site. I then worked with the Wildlife Health Team to finalize selection of four cases (the number of cases was determined in large part by funding and time available). We eventually chose (a) Sleeping Bear Dunes National Lakeshore, MI, from the Midwest Region, (b) Fire Island National Seashore, NY, from the Northeast Region, (c) Golden Gate National Recreation Area, CA, from the Pacific West Region, and (d) Wrangell-St. Elias Park and Preserve, AK, from the Alaska Region (Map 1).

Map 1: Locations of cases within the United States

Interviews.

In the spring, summer, and autumn of 2009, I visited each study site for two weeks to conduct in-person intensive interviews with NPS employees and community members. In individuals' offices, homes, and in restaurants I conducted 106 interviews (Table 1). When considering perceptions of wildlife diseases in the context of an NPS unit, there are three relevant sub-populations of individuals with whom a researcher could speak: NPS employees, community members (who may or may not also be park visitors and/or volunteers), and park visitors from outside the local community. I interviewed only the first two groups due to feasibility constraints. Several diseases and/or vectors in the study sites were not active during my fieldwork; therefore, visitors to these NPS units would have had little opportunity to become aware of risks associated with these diseases. I was able to learn, albeit second-hand, about visitors' initial perceptions and reactions to a disease through speaking with NPS employees who dealt with visitor questions, concerns, and complaints at times when the disease risks *were* recognizable to visitors.

I purposefully sought to identify and interview a cadre of NPS employees and community members who would be able to describe how the public writ large experienced, perceived, and responded to the disease(s) and any associated risks, due to interviewees having ample interaction with the public. I explained my criteria for interviewee selection to my initial NPS contacts, who then provided me with a list of potential NPS and community members to interview. This list from each study site and names mentioned in local mass media reports formed the basis for snowball sampling, which I used to identify additional important interviewees.

I scheduled interviews until I had a list of individuals who could comment on a broad spectrum of society. I then conducted interviews at each study site to the point of saturation (i.e., until I heard the same factors affecting risk perceptions and

reactions being cited consistently and no longer heard any new factors). In some cases, this meant scheduling additional interviews after my initial list was exhausted.

Table 1. A summary of interview activity by case

Study site	NPS Region	Interview period (2009)	# of interviews with NPS employees	# of interviews with community members	Total # of interviews
Sleeping Bear Dunes National Lakeshore (MI)	Midwest	April, May	17	9	26
Fire Island National Seashore (NY)	Northeast	May, September	16	12	28
Golden Gate National Recreation Area (CA)	Pacific West	June	17	11	28
Wrangell-St. Elias National Park and Preserve (AK)	Alaska	September-October	10	14	24

Saturation, I must note, is a subjective goal, not an objective construct. The researcher must identify for himself when no new factors emerge from interviews. Because I conducted all interviews and analyzed the data myself, I acknowledge that I may have failed to identify a newly emergent factor in an interview that another researcher would have noticed. I feel confident that my double-checking of notes in

the field, memo writing (discussed later in this chapter), and systematic coding of the data allowed me to identify most if not all factors that interviewees cited.

At each study site, interviews with community members included conversations with local residents, journalists, NGO members, and officials in other governmental agencies. Additionally, in some study sites I also interviewed politicians, local businesspersons, and NPS volunteers. In terms of NPS employees, I interviewed park administrators, natural resource managers, law-enforcement rangers, maintenance workers, and interpretative rangers at each unit. I conducted interviews with visitor use assistants, cultural resource managers, safety officers, and public affairs specialists in some cases.

Data logging.

I captured nearly all interviews on a digital audio recorder and took notes during each interview. For the four interviews in which interviewees requested not to be recorded, I took detailed notes during the interview and expanded these notes immediately following the conversation. I used the digital audio files and written notes to transcribe the interviews. Following best practices for qualitative research, I transcribed the interviews myself, as opposed to contracting the task out to someone else (Lofland et al., 2006). Because of the large number of interviews (n=106), averaging 45-50 minutes each, the transcriptions were not word-for-word accounts of the interviews, but rather were blends of notes, detailed summaries of pieces of the interview, and verbatim accounts of particularly important comments. This approach is consistent with the practices recommended by Lofland et al. (2006, p. 107-108). The transcriptions also included fieldnotes about the interviewee or location that I found relevant to the analysis, and parenthetical comments about emerging factors affecting risk perceptions or relationships to data from other interviewees.

I engaged in constant "memo writing" throughout the interviewing, data logging, and data analysis process. Memo writing occurs when a researcher chronicles ideas about his data and his field experiences in real time. For me, in the field, this consisted of taking notes about the physical and social setting of the study sites that I gathered through (a) observation, (b) material from informal or casual interviews, and (c) information from "interviewing by comment." Informal or casual interviews consist of asking questions in the course of naturally occurring activities, such as speaking with a waiter or shopkeeper about the local area (Lofland et al., 2006). "Interviewing by comment" is a more indirect way to ask a question; the researcher hopes to educe a response by merely offering a comment or an opinion. While these informal interviews and interviews by comment did not contribute to the data I eventually coded, they did help me understand the local context better and construct useful probes to statements made by my interviewees, which I would not likely have thought of otherwise.

Memo writing continued after leaving the field. While transcribing, I took notes on interconnections between factors affecting risk perceptions cited by interviewees within and across study sites. While coding the data, I wrote memos to help clarify what each code did and did not include. Memo writing also helped me to classify relationships and patterns between codes that allowed me ultimately to identify emergent factors that affected risk perceptions about and reactions to wildlife and vector-borne diseases.

Data analysis.

After transcribing the interviews, I used NVivo8 (version 8.0.335.0, QSR International, 2009), a qualitative data analysis software package, to code the 106 interviews for factors that affected individuals' risk perceptions and reactions with respect to wildlife diseases. Coding was an iterative process that involved me reading

each transcript and searching for reference to any factor that affected the interviewee's own risk perceptions or the risk perceptions of someone else with whom he/she directly interacted. (Each interviewee was a person who had substantial public involvement with the disease and/or the associated risks that I was studying.)

In line with the tenets of Grounded Theory (Glaser & Strauss, 1967), I allowed codes to emerge from the data (i.e., I did not approach the data searching for specific codes). First, I coded the transcripts for each unique way in which someone perceived a risk (e.g., seeing dead birds leads to heightened risk, seeing many ticks leads to heightened risk, etc.) and assigned each code a name. I applied codes that emerged in a transcript to each following transcript; every time a new code emerged, I re-examined all previously coded interviews to check for instances of the code. As codes emerged, I matched related codes to reveal relationships and patterns linking codes together; I then condensed related codes into broad factors that revealed similar concepts (e.g., visibility of disease vectors or effects). Each factor represented a distinct set of influences on risk perceptions and/or reactions in one or more of the four cases. The final coding scheme included twenty factors. I present those factors in chapter five.

Member checks.

After completing transcriptions, coding, and identifying quotes that exemplified the various emergent factors, I e-mailed draft copies of an initial data summary to twenty-five of my interviewees for the purpose of member checks. I asked this key group of informants, including NPS employees and community members from each case, to review a general description of environmental/geographic and social aspects of their study site and to examine for accuracy the quotes of theirs that I used to exemplify emergent factors. I then updated my data summary and study site descriptions to reflect the responses I received.

Researcher Biases and Characteristics

A key tenet of qualitative investigation, indeed, of all research, is that the investigator cannot be separated from his research design, data collection, data analysis, and generation of findings. This is both a virtue and drawback of qualitative (and quantitative) inquiry. The findings that emerge will always be, in some way, unique to the particular researcher who asked the research question, conducted the interviews, logged the data, and analyzed those data. In data collection, logging, and analysis, my academic background, personal views, and cultural situation necessarily affected the data.

My exposure to risk research certainly conditioned the types of factors affecting risk perceptions and reactions that I most readily noticed when coding data. My upbringing as a middle-class white male from northern New York State may have made factors present in my own cultural context more recognizable than those foreign to me; alternatively, I may have found foreign factors more easily identifiable due to their novelty. How I have personally perceived and dealt with risks certainly helped me identify certain factors as emergent. For example, the "part of life" and "ubiquitous" factors identified in chapter five were immediately evident in the data because I tend to perceive most risks as nuisances with which one must simply deal.

When asking open-ended questions derived from answers to previous questions, a researcher's own curiosities and exposure to theoretical and empirical literature will certainly shape the probes he asks. I worked to ensure rigorous and systematic data collection by carefully preparing for each interview in advance; yet, even with the exact same preparation, different probe questions would enter the minds of two interviewers interacting with the same interviewee. Similarly, when coding data, even a researcher who engages in extensive memo writing and iterative review of

transcripts will not likely identify the same set of factors affecting risk perceptions as another equally engaged and prepared researcher.

No research can be free of all personal bias. I made reasonable efforts to remove my personal influence from the data. While I may not have identified every important factor affecting risk perceptions and reactions that another researcher would have observed, I am confident that I identified the major factors.

The purpose of this research was exploratory; it allowed important factors affecting risk perceptions and reactions to emerge from the interview data. This type of investigation will always require a researcher's creativity to discover novel patterns and relationships. I carefully reflected on my personal involvement in shaping the data in each stage of my research and attempted to avoid attending only to data that supported my views on development of risk perceptions and reactions.

Conclusion

This chapter describes my overall research design and provides a rationale for the methods I used. An important aspect of this qualitative, multi-case study research only touched on here is the widely varied context in which each case was situated. Yin (2009) reminds us that case studies are most valuable in those instances where it is impossible to disentangle the phenomena being studied (e.g., risk perceptions and reactions) from the context in which those phenomena emerge (e.g., the NPS units and surrounding communities). The next chapter details, for each case, important components of the cultural, social, environmental/geographic, and epidemiological contexts in which the diseases emerged.

Chapter Four: Defining the Four Cases

"A whale ship was my Yale College and my Harvard."

-- Herman Melville (1819-1891), *Moby Dick*

The data from my interviews at the four study sites (i.e., NPS units and surrounding communities) support theories that emphasize the importance of local cultural and social context in affecting risk perceptions and reactions. The data also point to the relevance of local physical characteristics in affecting risk perceptions and reactions, through their influence on the social and cultural context and the characteristics of a disease or disease vector. In chapter five, I identify specific ways in which populations aggregately perceived risks at each study site and discuss how these ways of understanding and reacting to risks differed between cases. For that discussion to make sense, however, one requires at least a cursory understanding of social, cultural, and disease characteristics that define each case, and the similarities and differences in these characteristics across cases.

In this chapter, I describe each case with reference to four components: **the park** (physical, spatial, and historical characteristics of the NPS unit), **the place** (characteristics of the area surrounding the NPS unit), **the people** (descriptions of values, beliefs, activities, and interactions), and **the problem** (the disease[s] and associated risks). I place the risks associated with the disease in the context of other issues in the NPS unit and local community, consistent with how many interviewees chose to discuss their experience with the disease(s). Because the park, the place, the people, and the problem for each case are obviously highly interconnected, the characteristics discussed in each sub-section overlap. The separation of each case into

these components should not be viewed as an indication that each component is distinct; rather, the separation is merely an organizational device.

Because the purpose of this chapter is to provide a background for understanding the data that I present and discuss in chapter five, I do not necessarily provide the same details about each case. Indeed, providing every detail I recorded about each case would lead to a monstrously large tome. I offer here only those features of each case that are needed to understand the factors affecting risk perceptions discussed in chapter five. Information about the cases comes from my fieldwork, primarily from the intensive interviews, supplemented with the archival data referenced in the preceding chapter. Therefore, one could consider chapter four the first of two results sections. It catalogs some of cultural, social, environmental/geographic, and epidemiological characteristics of each case that influenced risk perceptions and reactions. Chapter five details *how* these characteristics contributed to and conditioned perceptions and reactions.

Sleeping Bear Dunes; Leelanau and Benzie Counties, MI

The park.

Authorized by Congress in 1970, Sleeping Bear Dunes National Lakeshore (SBDNL) covers thirty-five miles of coastline in northeast Michigan in addition to two nearby islands in Lake Michigan. SBDNL possesses an excellent example of the flora and fauna associated with the Great Lakes Dunes ecosystem (www.nps.gov/slbe). SBDNL also contains inland lakes, marshes, fields, and forests. The general shape of SBDNL is long and thin, curving along the shoreline of Lake Michigan (Map 2). SBDNL surrounds two small municipalities, the village of Empire and the township of Glen Arbor, both with populations less than 800 persons.

Map 2: Sleeping Bear Dunes National Lakeshore

Throughout the history of the National Lakeshore, there has been some controversy between SBDNL and local communities. Local residents and long-time NPS employees I spoke with recalled SBDNL's proposal to designate some of its lands as wilderness in the 1980s; the local public realized that this would involve removing roads to some popular beaches. Public outcry stalled the plan in the 1980s; SBDNL eventually addressed these concerns in its general management plan (GMP) that came into effect in January 2009. The next largest conflict historically, according to interviewees, has been over closure of some beaches to dog walking to protect the nesting habitat of birds such as the federally endangered piping plover.

Despite a few sources of tension between SBDNL and the local communities today, the National Lakeshore currently seems to have rather amiable relations with the local population in Leelanau County and the nearby city, Traverse City, according to NPS staff and local community members. My interviewees identified the park's transparency in the most recent GMP discussions (2003-2008) as a major factor that reinforced local residents' trust in the park administration. This process struck a balance between natural resource protection and visitor use that appealed to the local communities.

The place.

Two distinct types of communities surround Sleeping Bear Dunes National Lakeshore: (a) the small towns and unincorporated rural areas of Leelanau and Benzie Counties and (b) the larger "urban" center of Traverse City. Traverse City had 14,532 inhabitants as of the 2000 census (http://factfinder.census.gov). Leelanau County had 21,119 residents and Benzie County had 15,998 residents according to the same census. The racial composition of Leelanau County is over 93% Caucasian, with Native American as the largest minority group. The county is one of the wealthiest counties per capita in Michigan ($32,169 average per capita income as of 2008,

compared to a state average of $25,651 and a national average of $27,466) (http://factfinder.census.gov). Leelanau also has one of the highest average levels of education (39.7% of the county residents had bachelor's degrees or higher as of 2008, compared to a state average of 24.7% and a national average of 27.4%). The area has attracted retired people and second-home owners.

The area surrounding SBDNL has a relatively rural character. The region is known nationally for its cherry orchards and the National Cherry Festival that occurs in Traverse City each July. Tourism and recreation account for much of the area's economic activity. Due to the large amount of water in the region, much tourism and recreation is aquatic-based (86% of Leelanau County, which contains most of SBDNL, is water). Leelanau County is a large peninsula that forms the northwest tip of the lower peninsula of Michigan; it is bounded by Lake Michigan to the west and Grand Traverse Bay to the east. Much of the land surrounding SBDNL is used for agriculture. The region's flat, sandy soils support hardwood and conifer forests.

The people.

The community members I interviewed at this study site were primarily engaged citizens who worked for non-profit educational and advocacy organizations that mobilized around the Type E botulism issue. These individuals represented officials and volunteers with five NGOs that worked with each other and with SBDNL to address risks associated with botulism. Journalists from the two local newspapers and a natural resource manager from a local Native American tribe rounded out the sample of nine interviewees from the local communities.

The local residents are also highly engaged in the community, according to several interviewees involved with community non-profit organizations. The interviewees all confirmed that a relatively high percentage of the local residents are members of community groups and non-profits, compared with other areas in

Michigan. SBDNL is connected to local communities through the programs it provides for schoolchildren. The National Lakeshore also connects to local residents through reliance on volunteers to help with natural resource management projects and by working with local environmental NGOs and Northwestern Michigan College.

SBDNL disseminates information to the public primarily through (a) the many public forums it held related to the recent revision of its General Management Plan, (b) regular press releases to the commonly read and highly praised local newspapers in the region, and (c) the annual newspaper that SBDNL distributes. The National Lakeshore distributes information internally to its employees (approximately 60 full-time employees, not including seasonal staff) through weekly e-mail updates, a weekly newsletter, and radio traffic on SBDNL's internal communication channel that informs the employees about important topics and how to learn more about them. With respect to Type E botulism, the disease issue I studied at this site, one NPS employee took the lead on informing staff and the public; he stood out as the point person for the issue. Every community member and every NPS employee I spoke with cited the name of the head SBDNL biologist as a source of information on botulism.

Swimming, boating, fishing, beach walking, and any other activities that focus on water are central components of life in this region. Hiking, bird watching, wildlife viewing, and other terrestrial outdoor activities are also common pursuits amongst the local residents. Interviewees constantly reminded me that many individuals and families move to and live in Traverse City, Leelanau County, and Benzie County due to the natural beauty locally. NPS employees and community members offered that local residents, particularly the residents of Leelanau and Benzie Counties, commonly visit SBDNL to use the beaches for dog walking, sun bathing, swimming, or picnicking. Locals from Traverse City use the campgrounds for weekend retreats and use the National Lakeshore's woods for hunting deer. NPS officials explained that

visitors from outside the region generally come from southern parts of Michigan and other areas in the Midwest. Large majorities of the visitors staying at SBDNL's two campgrounds are repeat visitors; many return year after year.

The problem.

I focused primarily on risk perceptions of Type E botulism at this study site. Botulism occurs when a common bacterium (*Clostridium botulinum*) produces extremely potent toxins under anoxic conditions. Interviewees indicated that the risks and concerns at this study site arose from the complex role of botulism in the local ecosystem. Scientific understanding of the causes and effects of botulism outbreaks is still incomplete, but scientists from the NPS, local NGOs, and a local college reported that the best information to date suggests that *C. botulinum* proliferates in decomposing *Cladophora* algae mats in the benthic regions of Lake Michigan (and several of the other Great Lakes). During the proliferative stage (or "vegetative stage of the bacteria"), botulinum toxins, which are one of nature's most poisonous substances, are produced. These toxins can be taken up by benthic invertebrates (worms, aquatic insects, etc.).

In recent years, a relatively new invasive species, the quagga mussel, has increased exponentially in the benthic areas of Lake Michigan; these mussels may ingest and concentrate botulinum toxins as they filter the water for nutrients, while nestled in among the cladophora mats. Round gobies, a voracious exotic fish species, feed extensively on these quagga mussels and many invertebrates in the algae mats; they most likely ingest the toxins. Biologists I interviewed who examine the effects of botulism explained that the toxin soon disables and eventually kills (within 1 to 2 days) the gobies. Diving ducks and fish-eating birds such as cormorants and loons opportunistically feed on the disabled fish. When dead gobies, and smaller numbers of native fish that are also poisoned, wash up on shore, gulls and other scavengers that

eat the fish become affected. The botulinum toxin affects the neurology of the birds so they can no longer fly, walk, or even hold their head out of water to keep from drowning. The birds die shortly after ingesting the toxin. Many dead birds and fish then wash up on the beaches. This complex ecological process has led to several large die-offs of birds near SBDNL.

According to NPS biologists and other scientists who study the Great Lakes ecosystem who I interviewed, Type E Botulinum toxin can be harmful to humans and other terrestrial animals that ingest it. These scientists, however, agree that the dead birds or dead fish in northern Michigan pose no threat to human health because people are unlikely to eat the gobies or fish-eating ducks and waterfowl. The toxin also decays quickly in dead animals on the beach that are exposed to direct sunlight. Botulism experts suggested that the single most likely source of botulism that could affect humans (associated with an outbreak of the sort near SBDNL) would be from catching a large salmon, trout, or sturgeon, which had recently ingested some toxin-affected smaller fish (such as gobies). The experts I interviewed recommend not eating obviously sick or lethargic fish, properly cleaning them (which removes most of the toxin in the gut), and then properly cooking all fish. The only documented cases of humans becoming poisoned from Type E botulism in Great Lakes fish involved cold smoking processes and no cooking. The scientists working on the botulism outbreaks in northern Michigan also affirm that swimming in a lake the size of Lake Michigan poses no threat to human health from the botulinum toxin.

While botulism has been a persistent issue in the eastern Great Lakes since the 1990s, and there were occasional botulism die-offs in Lake Michigan dating back to 1963, the 2006 die-off in Lake Michigan gained considerable attention from Michigan residents. In autumn 2006, about 2,900 birds, mostly gulls, cormorants, and common loons, washed up on the shores of SBDNL. Initially, the NPS biologists did not know

the cause of the die-offs and suspected possible starvation in the many young gulls and cormorants that had recently fledged. The NPS then sent bird carcasses to a state laboratory, which reported Type E botulism as the cause of death. In 2006, the carcasses washed up almost exclusively on the shoreline of the National Lakeshore.

Local community members and NPS officials recalled that the initial emergence of the dead birds solely on SBDNL lands prompted many local residents to view the bird die-offs as something associated with the National Lakeshore. This is not to say that the residents blamed SBDNL, but they certainly looked to the NPS as a key source of information about what was happening, what the implications of the die-offs were, and what they could do to help with this problem. In summer and autumn 2007, between 7,000 and 8,000 dead birds were documented across more than 1,000 miles of shoreline stretching from south of SBDNL, north to the Mackinac Bridge, and along the upper shore of Lake Michigan, west to Wisconsin.

According to several interviewees, the head biologist at SBDNL and researchers and biologists throughout the Great Lakes framed the botulism issue as a problem emanating from the continued introduction of invasive species into the Great Lakes. These scientists identified the quagga mussels and round gobies as two key links in the die-off chain. These mussels, along with their cousins, the zebra mussels, have greatly increased water clarity, which allows for proliferation of the native Cladophora algal mats that then facilitate the growth of the botulism bacteria.

The botulism outbreak was a major issue for Sleeping Bear Dunes and the surrounding communities during late 2006 and throughout 2007. In 2008, the visible effects of botulism were much less pronounced; monitoring for bird carcasses identified less than ten percent as many dead birds on the beaches compared to the previous year. Due to the magnitude of die-offs in 2006 and 2007, the botulism issue received substantial press during these years from the two local newspapers with the

largest circulation, the Leelanau Enterprise and the Traverse City Record Eagle. My review of newspaper archives and interviews with local journalists revealed that these newspapers published articles with considerable scientific background on botulism as well as pictures of the bird carcasses lining the lakeshore. NPS administrators at SBDNL stated that after they realized the 2006 die-offs were not an isolated incident, the National Lakeshore worked with a local non-profit education organization, two advocacy non-profits, and the local community college to create a program to train volunteers to monitor the lakeshore for birds killed by botulism. This collaborative team trained more than 100 community members who monitored hundreds of miles of lakeshore in 2008.

During 2006 and 2007, the effects of botulism were one of the largest issues that SBDNL had to deal with, probably the biggest issue aside from the finalization of the General Management Plan according to multiple NPS officials. By the time I conducted interviews in April and May 2009, attention to the issue had lessened. Every interviewee who worked at SBDNL or lived in the local community in 2006 and 2007 readily remembered the issue and its importance to the community, but each individual also reported that attention to the issue had subsided substantially over the last year. Two NPS employees I interviewed who had worked at SBDNL for just under a year stated that they had never heard anyone mention botulism other than reminiscing NPS employees.

Fire Island National Seashore; Fire Island and southern Suffolk County, NY

The park.

Established by Congress in 1964, Fire Island National Seashore (FINS) encompasses twenty-six miles of Fire Island, a thirty-two-mile long and quarter-mile wide barrier island off the southern coast of Long Island (www.nps.gov/fiis). Twenty-five percent of the land on Fire Island, within the boundary of the National Seashore,

is developed; this includes two incorporated villages, fifteen other municipalities, and a historical site, the Fire Island Lighthouse (Map 3). Another historical site, the William Floyd Estate is located across the Great South Bay from Fire Island, on the mainland of Long Island.

FINS is flanked on its western end by Robert Moses State Park and on its eastern end by Smith Point County Park, which actually lies within the FINS boundary. The National Seashore contains several ecosystems, including maritime forests, wetlands, beaches, swale, and fields (www.nps.gov/fiis). Wetlands are by far the most prevalent terrestrial ecosystem in FINS. The National Seashore contains a seven-mile federally designated wilderness area on its eastern end, the only federal wilderness area in NY State. A portion of the Great South Bay and part of the Atlantic Ocean are also within the FINS's boundaries.

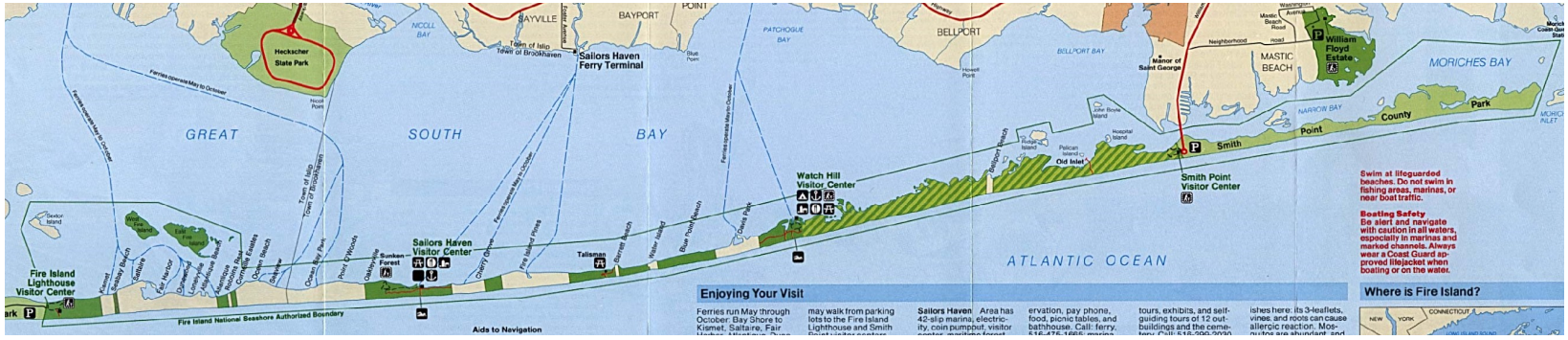
NPS officials explained that the first conception of a Fire Island National Seashore emerged in the 1950s, when the NPS conducted a study of seashore areas to incorporate potentially into the national park system, and identified Fire Island as a candidate. Congress then acted on this proposal a decade later when it created FINS in part to stem a proposal to build a highway across the entire Island. While most residents of Fire Island's communities had a similar disinterest in seeing a highway hinder the natural beauty of their Island, local community members recalled that many were likewise unsupportive of the restrictions that came with living in a national park. Still today, NPS employees and community members I spoke with readily agreed that numerous residents are not fond of driving restrictions that require any resident with a car on the Island to have a permit. Restrictions also close parts of the beach to vehicle traffic at certain times of the year due to the presence of piping plover nesting sites (a federally listed threatened species). (This piping plover is the same species that is federally listed as endangered at SBDNL; the US Fish and Wildlife Service affords

different designations to the Atlantic Coast population and the Great Lakes population (www.fws.gov/plover/facts.html).)

Additional restrictions regulate the methods by which residents and communities can manage pests on the Island. While FINS allows localized insecticide fogging for mosquitoes *within* communities, local community members believe, and NPS employees admit, that the rest of the National Seashore acts as a refuge for mosquitoes that allows swarms to enter the communities after fogging is completed. Several interviewees informed me that real estate agents selling homes on the Island would often not inform buyers that the home is located within an NPS unit out of fear that the restrictions that come with living in FINS could reduce the desirability of the home.

The place.

Several diverse populations living on and near Fire Island could be considered communities of local residents. I included the municipalities on Fire Island and the community of Mastic Beach, NY, in the study site. The William Floyd Estate, the historic home and lands of a signer of the Declaration of Independence, is a part of FINS that is located on the mainland of Long Island, in the hamlet of Mastic Beach. Mastic Beach is a suburban Long Island community; on average, the hamlet has lower levels of income and postsecondary education, compared with the average in Suffolk County (10.1% of individuals with bachelor's degrees or higher compared to 27.5% in the county; $44,937 median household income compared to $65,288 in the county) (2000 census, factfinder.census.gov). Mastic Beach is ethnically similar to Suffolk County (88.2% white compared with 84.6% white in the county). Based on a substantial amount of driving through the hamlet during my fieldwork, and observing its physical layout, Mastic Beach "feels" like a suburban American town.



Map 3: Fire Island National Seashore

The communities of Fire Island, on the other hand, are quite different. There are narrow boardwalks and some sandy paths that one can drive a car on in these communities, but most access to Fire Island is via ferry. Walking or riding a bike is often the fastest and most direct means for travelling from one community to the next. Vacation homes abound and only a small percentage of the residents dwell on the Island permanently.

The people.

At this study site, my interviews with community members were primarily with engaged permanent residents of Fire Island communities. I interviewed eight such residents, including leaders of various community organizations, in addition to two residents of Fire Island who work in concessions operations in FINS, two officials associated with risk management entities in Suffolk County other than the NPS, an official from Robert Moses State Park on Fire Island, and a county legislator whose district contains part of FINS.

Three types of residents occupy the communities on the Island: permanent residents, summer property-owning residents, and summer renters. Residents on the Island indicated that people live there due to the natural beauty and the quaint culture (i.e., little use of cars in towns, small, isolated, and "walkable" communities, a beach town feel, etc.). Community members also explained that many summer renters come to the Island to vacation and party. Population sizes in Fire Island communities dwindle substantially after Labor Day each year and do not rebound significantly until Memorial Day. For example, according to a municipal official, the incorporated village of Saltaire has 2,000 residents mid-week in the summer and close to 4,000 on summer weekends, but only 50 year-round residents. Saltaire is the second largest of the seventeen communities on Fire Island. NPS and community member interviewees stated that at least one town on the Island has no more than one permanent resident

(this is not verifiable through census data as only two of the municipalities on Fire Island are incorporated). According to census data for the two incorporated villages, the average permanent resident earns close to the median income for Suffolk County. Interviewees stated that, based on rental prices and summer home prices on Fire Island, summer property owners and summer renters residing on Fire Island must earn substantially more than the median income for Suffolk County.

The National Seashore disseminates information to the public through press releases that often lead to articles in Newsday (a regional newspaper) and the bi-weekly newspapers on the Island. NPS administrators explained that FINS is also proactive in updating its website with detailed information on events and issues of concern. NPS employees deliver PowerPoint-style presentations about FINS and issues in the National Seashore to civic groups, interest groups, voting clubs, etc. Based on conversations with a range of NPS employees, interviewees seemed to indicate that internal communication about issues of concern reaches employees primarily in a top-down fashion, spreading through the administration and then reaching over 100 full-time NPS employees through their supervisors. Many NPS interviewees stressed the importance of new employee training, especially for seasonal employees, as a source of information about natural hazards that employees may experience in the course of their jobs.

The problem.

The problems of interest at FINS were Lyme disease and West Nile Virus (WNV). Lyme disease is tick-borne disease caused by bacteria of the genus *Borrelia*. It can lead to debilitating human health effects if not diagnosed and treated properly. The name Lyme disease was assigned to a certain set of symptoms ultimately associated with bacteria transmitted by ticks near Lyme, CT, in 1976. FINS employees recall documentation of the symptoms related to Lyme disease beginning

in the early to mid-1980s, although multiple long-time residents remembered people experiencing Lyme disease-like symptoms as early as the late 1960s. Multiple species of ticks exist on Fire Island, including the black-legged (i.e., "deer") tick and the Lone Star tick. While the Lone Star tick can transmit other tick-borne diseases, the black-legged tick is the only vector of Lyme disease on Fire Island. Multiple interviewees averred that while other tick-borne diseases can have serious health effects, virtually no one on the Island expressed concern over any tick-borne infection other than Lyme disease.

NPS biologists and local vector control ecologists explained that deer, mice, rats, and birds can serve as hosts for the *Borrelia* bacteria and may spread black-legged ticks across the Island and throughout the William Floyd Estate. Although ticks are tiny creatures, everyone I interviewed agreed that they are a visible part of the landscape on Fire Island and at the William Floyd Estate to anyone besides the most casual visitor, due to their high prevalence. A diverse array of interviewees (both NPS and community members) declared that it is common for one to enter the tall grass at the William Floyd Estate or the beach grass on the Island and emerge with literally over 100 ticks on his/her body. Even individuals who never leave the boardwalks or sandy paths may acquire ticks or see engorged ticks covering the overabundant deer on the Island or at the Estate.

While FINS employees did not agree on the percentage of NPS staff that had acquired Lyme disease, the majority of the employees I spoke with had contracted the disease at least once and many employees indicated that most of their colleagues had contracted the disease as well. Most island residents I spoke with also had contracted Lyme disease and two interviewees cited contracting Lyme disease four or more times. The threat of human health risks from Lyme disease led several schools with a history of bringing children to the Island and the Estate for nature and cultural

programs to discontinue their visits. NPS officials that work with the local schools recalled that school administrators were worried about the children's health and about angering parents by exposing their children to the ticks.

FINS administrators, biologists, maintenance workers, cultural resource managers, interpretative rangers, and law enforcement rangers were all able to identify quickly the various efforts that FINS has implemented to provide its employees and the public with information about Lyme disease. Employees are told about Lyme disease when interviewing for a job at FINS. During new employee training they are instructed in ways to protect themselves from Lyme disease and what to do if they suspect they have Lyme disease; they are offered free blood tests multiple times a year to check for Lyme disease. Now that some school groups are returning to the Island and the Estate, park rangers teach these children about how to prevent Lyme disease. Information cards on Lyme disease are available in all visitor centers and the interpretive rangers constantly offer solicited and unsolicited advice to visitors on how to protect themselves from Lyme disease.

The National Seashore has addressed the issue of Lyme disease primarily through informative communication, undertaking little physical management to control Lyme disease or ticks. The natural resource management program at FINS cites the NPS mandate of not interfering with natural processes and not altering ecosystems unless necessary. The only place where some control of ticks has occurred is at the William Floyd Estate where the NPS sprayed permethrin in 2008 to reduce the number of ticks in the area immediately surrounding the historic structures.

In response to FINS's policy on managing ticks, a coalition of residents sought to conduct a study on Fire Island to gauge the effectiveness of a technology called 4-poster devices. These devices apply permethrin to deer to kill ticks on the animals when they come to a feeding station. FINS initially would not support this use of the

technology because the National Seashore claimed that feeding the deer would interfere with an immunocontraception project that sought to reduce the number of deer on Fire Island. The NPS natural resource managers also had concerns about whether the devices were consistent with the NPS's pesticide policy. FINS eventually allowed three communities to install these devices as part of a research project. Several interviewees declared that the conflict over whether FINS would allow the communities to install 4-poster devices furthered the animosity and lack of trust that exists between the NPS and segments of the local population on Fire Island.

West Nile Virus (WNV), the other major disease issue on Fire Island, is transmitted by mosquitoes and can lead to flu-like symptoms in humans, possibly leading to death, particularly among young, old, and immune-compromised individuals. The virus first emerged in the USA in 1999, in New York City. WNV has now spread across the continent and has been detected in nearly every state. Interviewees recalled that communities on Fire Island became concerned about WNV due to the large amount of marshland on the Island.

According to the scientists I interviewed at this study site, the eastern saltmarsh mosquito (*Aedes sollicitans*) is the primary species of mosquito on Fire Island; these mosquitoes are low to moderately competent vectors of WNV (Ginsberg, 2005). Other rarer mosquito species on the Island, such as *Culex salinarius*, are highly competent vectors of WNV; therefore, the NPS set up mosquito traps across the Island. These traps attract and collect mosquitoes that researchers then test for WNV. The National Seashore's policy is not to allow pesticide application outside of localized fogging in communities, unless WNV is detected. This policy is consistent with the overall NPS policy not to allow pesticide use in parks unless there is an immediate threat to human health and safety.

My review of Newsday and New York Times archives revealed that the newspapers most commonly read on Fire Island covered the issue of WNV heavily during the first few years following its emergence in New York City. After the disease spread across the nation, newspaper attention declined in the aforementioned papers. Only two humans have been diagnosed with WNV believed to have come from a mosquito on Fire Island. FINS detects WNV once to twice a year in the mosquitoes it traps.

Interviewees readily recognized that attention to Lyme disease and WNV has waned among local residents over the past several years. Even today, with the two diseases receiving less attention than at their height, NPS officials identified the issues of mosquitoes (not necessarily associated with WNV, more likely related to quality of life issues) and ticks (likely associated with Lyme disease) as two of the three largest issues that FINS deals with among the public and employees. The other major issue for employees is poison ivy and the other major issue for the public is "beach nourishment," or replacement of sand that has eroded away from beaches that are favorite recreation spots.

Golden Gate National Recreation Area; San Francisco and Marin County, CA

The park.

Created by President Nixon in 1972, Golden Gate National Recreation Area (GGNRA) contains over twenty distinct sites spanning sixty miles of California's Pacific Ocean coast in San Mateo, San Francisco, and Marin counties (www.nps.gov/goga) (Map 4). GGNRA incorporates an array of physical environments, including beaches, rocky coastlines, Alcatraz Island, old Army forts, green spaces and historical sites in San Francisco, a coastal redwood forest, and extensive open space north and south of the city. These open lands contain coastal chaparral, marshes, forests, and low mountains. The sites that comprise GGNRA are

scattered throughout the three counties and generally are not connected, although the Marin Headlands does represent a large continuous tract of land. Because the sites are spread out and fragmented, I focused interviewing on community members and NPS employees that lived and worked in Marin County and on the north side of the city of San Francisco.

Local residents and NPS officials aware of GGNRA's history recounted that the NPS unit was created due to a strong sentiment among local residents that green spaces in San Francisco and open spaces in the surrounding areas needed to be protected from sprawling development. The lands now incorporated in the park came from many sources. The Army sold or donated several parcels to the NPS; the Nature Conservancy, municipal governments, and wealthy private citizens also contributed land to the National Recreation Area.

GGNRA had a policy of taking almost any land it was offered in the greater San Francisco area, thus the National Recreation Area grew substantially over thirty years as governments and individuals sought to see their lands perpetually preserved in their natural or historic state and made available for recreational use. Contrasting with the origins of many national park units, the creation of GGNRA did not lead to controversy among local residents. Those familiar with GGNRA's history shared that the majority of the residents were happy to see recreational opportunities and biodiversity preserved in the area.

The place.

A diverse physical and social landscape accompanied the segmented park throughout the study site. The northern reach of San Francisco, the southern end of the study site, is a densely populated urban center. Central-western Marin County, the northern end of the study site, is a rural community dependent on cattle grazing. Bolinas, in west Marin, on the Pacific Ocean, is a bohemian community that helps to

protect nude beaches and the homeless population as part of its culture. Sausalito, in southern Marin, is a trendy, artsy community. Eastern Marin County is suburban and moderately to highly developed in areas; the county becomes increasing rural as one follows winding roads westward to the small towns near the Pacific Ocean. The array and quantity of open land in Marin County, the county just across the Golden Gate Bridge from San Francisco, is substantial (Map 4). A state park and several Marin County Open Space preserves adjoin the NPS holdings.

Marin County is distinct as a county with extremely high levels of postsecondary degrees (51.3% of Marin County residents, compared to 26.6% in California, and 24.4% nationally) and per capita income ($44,962 in Marin, compared to $22,711 in California, and $21,587 nationally). The county is considerably more racially homogenous than California (84.0% white in Marin versus 59.5% white in the state). Many interviewees were quick to cite Marin's abnormally high level of education as one of the factors affecting the ways in which local community members perceived risks related to wildlife and vector borne diseases.

While the NPS unit I chose to study was GGNRA, it is important to mention that another NPS unit exists in Marin County, Point Reyes National Seashore. The Seashore is located in the northwestern corner of Marin County and its southern lands border some of the northern reaches of GGNRA's Marin Headlands. Point Reyes actually administers some of GGNRA's northern lands. The presence of Point Reyes is important for understanding this study site because multiple interviewees affirmed that local residents often do not distinguish between which national park they are in, and some do not distinguish between state park, national park, or county open space. For the local residents, these lands work together to create a network of natural areas.

Map 4: Golden Gate National Recreation Area

The people.

At this study site, the interviews with community members were primarily with bureaucrats of one form or another who deal with the public on wildlife and vector-borne disease issues on a regular basis. I interviewed an official at the county vector control district, three officials from state, county, and local health departments, three area journalists, two local residents who were active in their communities, two staff members of a town supervisor, and a naturalist for a local open space district. All of these individuals were involved with Lyme disease and/or WNV issues in Marin County.

The recreation area is firmly connected to the local communities as evidenced by the 390,000 volunteer hours performed in the park annually (www.nps.gov/goga). This volunteerism, the highest amount of any NPS unit, is equivalent to approximately 188 additional full-time employees, according to an individual in the GGNRA public affairs office. The sheer volume of visitation, over 17 million park visits annually, many from local residents, also speaks to the integral role of the park in the lives of community members. As of 2000, the city of San Francisco contained nearly 800,000 residents; more than four million people resided in the greater metropolitan area (factfinder.census.gov). Many of these people rely on the park's lands for daily recreation opportunities and weekend retreats. According to NPS data supplied by interviewees, the people who most frequently experience nature in the park are local residents who engage in activities such as horse riding, mountain biking, trail running, surfing, windsurfing, swimming, and other beach-related activities.

With four million potential *local* constituents to communicate to, GGNRA obviously has no easy job disseminating information to its vast public. The visitor population extends further, including a substantial international population. NPS officials contended that non-local visitors to GGNRA are even more diverse than the

local residents are. Visitors come from across the globe; many only experience the cultural or historical sites and a small percentage spend more than an hour experiencing nature. Public affairs officials and other NPS administrators explained that the segmented and urban character of the park also makes information dissemination difficult. Many issues in San Francisco take precedence over park issues in the local mass media outlets, particularly in the San Francisco Bay area. Several interviewees characterized the quality of newspaper and television reporting in the region, particularly from the San Francisco Chronicle, as poor, lazy, and embarrassing (although some interviewees did praise the reporting efforts of smaller local papers in northern and western Marin County).

Attempting to disseminate information to GGNRA employees can be an arduous task as well, with 420 full-time equivalents. Most employees I interviewed identified the online newsletter e-mailed weekly as the source by which important information generally reaches them. GGNRA additionally focuses on providing substantial safety information to their employees during new employee training (something that NPS interviewees with diverse job descriptions mentioned). NPS supervisors are very proactive in informing their employees and volunteers about Lyme disease and supplying them with appropriate efficacy information for preventing exposure to the disease.

GGNRA was unique among my study sites in that the Recreation Area holds a "safety week" for its employees each year, where employees are given liberal allowance to attend presentations, over five days, on multiple aspects of being safe and protecting oneself while on the job. Some divisions require their employees to attend these presentations while other divisions afford their staff the opportunity to attend as an optional activity. Each year there are several presentations on wildlife and vector-borne disease issues. One person, the integrated pest manager for GGNRA,

coordinates all of the disease presentations. He delivers some presentations himself and finds outside experts to present others. GGNRA may have more capacity than other NPS units to offer such presentations on disease issues, because few units have their own integrated pest manager.

The problem.

The problems of interest at this study site were Lyme disease and West Nile Virus (WNV), the same issues about which I studied risk perceptions at FINS. The ecology and epidemiology of these diseases differed considerably from the situation in New York. According to a local vector ecologist, the first documented case of Lyme disease on the west coast was in 1978 in Sonoma County, CA (the county bordering Marin County to the north). WNV first emerged in California in 2003, but did not affect a Bay area resident until 2005. NPS scientists and health officials stated that the vectors for both of these diseases, mosquitoes and ticks, are more prevalent in the Bay Area than in much of CA, but they are virtually non-existent there compared to their presence on the east coast. Deer ticks (*Ixodes scapularis*), which are responsible for transmission of Lyme disease in the eastern U.S., do not exist in the Bay area; the western-black-legged tick (*I. pacificus*) spreads Lyme disease in California. While mosquitoes are a large problem in some neighborhoods in Marin County, a park-commissioned study revealed that GGNRA is not a source for mosquitoes in communities due to the small amount of standing water in the Recreation Area.

Over 100 vertebrate species have been identified as hosts for *Ixodes pacificus* in California, with birds, rodents, deer, and lizards serving as primary hosts for ticks (Castro & Wright, 2007). The scientists and public health officials I interviewed, however, believed that deer play a minimal role in the ecology of Lyme disease in Marin County. According to a public health official and vector ecologist I interviewed, birds may be the primary transporters of ticks in the Bay Area of CA, and

may act as reservoirs for the Lyme bacteria. In addition to lower numbers of ticks, Lyme disease also exists with lower frequency in the tick populations on the west coast compared to the east coast. The reasons for this are not known with certainty, however, a possibility cited by NPS scientists and public health officials I interviewed is that lizards that serve as hosts for nymphal ticks have a protein in their blood that kills the Lyme disease-causing bacteria in the ticks.

Individuals at GGNRA and FINS are exposed to WNV differently. NPS employees and the public at GGNRA are not exposed to many mosquitoes because of the relatively low prevalence of mosquitoes in CA, compared to NY, and the fact that most areas within the Recreation Area are day-use areas where people do not remain at dusk, when mosquitoes are most active. A YMCA camp in the Marin Headlands and the community of Stinson Beach, areas of GGNRA where people reside 24 hours a day, historically have expressed the greatest concern about WNV, according to NPS biologists.

While conducting fieldwork, I learned about a third human health concern at GGNRA that I was completely unaware of when I started interviewing individuals in the Bay area. Several employees on Alcatraz expressed perceptions of disease risks associated with the huge amounts of bird droppings (guano) covering the Island. Few employees cited a specific disease or health concern associated with the guano, but multiple interviewees working on Alcatraz mentioned that many of their colleagues on the Island believed that something as disgusting and foul smelling as the guano had to be bad for human health and must pose some disease threat.

Gardeners and landscapers must work in areas covered in guano and maintenance workers are responsible for cleaning the parade grounds on the Island each fall after a thick layer of guano has accumulated over the spring and summer. Birds nest all over the Island and constantly defecate on workers and the 1.4 million

annual visitors, according to multiple long-time Alcatraz Island employees. An official in GGNRA's public affairs office reported that visitors worried about the health of their children and visitors who brought groups of immune-compromised individuals to view the Island were most vociferous about their perceptions of health risks. The park conducted a study that did not detect any disease associated with the guano. The park then provided better sanitation facilities on the Island and access to full personal protective equipment (PPE) to ease workers' concerns.

All interviewees readily agreed that none of the disease risks I studied at GGNRA rose to the level of major problems in the Recreation Area or became issues drawing consistent attention from members of the local communities. Some issues (e.g., Lyme disease) drew substantial attention *within* communities, but perceived risks were not associated with experiences in GGNRA. NPS officials acknowledged that the guano issue precipitated the most health concern of any of the "diseases", even though visitors and employees could not identify the specific risk to human health.

The largest conflicts and issues of trust in the park today focus on conflicts related to dog walking. People in San Francisco have an intense sense of ownership over the park's lands; many people visit these lands daily and have little opportunity to experience nature elsewhere. Therefore, conflicts between user groups frequently emerge, particularly between people with dogs off leash and people not wishing for an unruly animal to disrupt their recreation, peace, or safety. Dog walking conflicts are much more visible in GGNRA than any disease issue.

Wrangell-St. Elias National Park and Preserve; eastern Alaska

The park.

Established by Congress in 1980 as part of the Alaska National Interest Lands Conservation Act (ANILCA), Wrangell-St. Elias National Park and Preserve (WSEPP) includes more land area than any other unit in the national park system,

covering 13.2 million acres in eastern Alaska, an area larger than the states of Vermont and New Hampshire combined (www.nps.gov/wrst) (Map 5). The park was named for the Wrangell and St. Elias mountain ranges that run through it. The ecosystems covering this vast swath of land include boreal forests, alpine tundra, and marine ecosystems where the park touches the Pacific Ocean. The park contains numerous glaciers (including North America's largest piedmont glacier and the world's longest interior valley glacier) and Alaska's largest active volcano. Three distinct caribou herds populate the park. Other notable wildlife species include moose, Dall sheep, mountain goats, two herds of introduced bison, grizzly bears, black bears, wolves, and the vast number of trumpeter swans and Canada geese that migrate through the park biannually. The Copper River that forms the western border of the park contains large quantities of sockeye (red) and Chinook (king) salmon. Interviewees were proud to inform me that the treasured salmon from this river and its tributaries have historically been the most important resource for sustaining Alaska Native communities in the area.

WSEPP contains some lands that are designated as national park and others designated as national preserve. The federal government permits different activities in each zone. Park officials explained that under federal subsistence regulations, residents of rural communities in and around WSEPP can hunt, fish, and trap for subsistence on park *and* preserve lands. Individuals from areas not federally recognized as subsistence communities can hunt on preserve lands only. Aircraft can be used to access preserve, but not park, lands for hunting and fishing. Community member interviewees were quick to point out that this restriction prevents hunting, even by members of "resident zone communities," on most of the national park lands due to lack of roads and difficulty of access. This restriction was not in place before the existence of the park and is still a contentious issue for some local residents.

Map 5: Wrangell-St. Elias National Park and Preserve

In terms of community-park relations, interviewees revealed that many local residents were extremely concerned when President Carter designated the area now part of WSEPP as a national monument in 1978, and then when Congress approved it as a national park and preserve in 1980. Some locals worried that the park's presence would limit their freedoms and alter their lifestyle. Locals became angry with the NPS for limiting their ability to hunt and access the land as they previously had. NPS and local resident interviewees confirmed that outraged locals opened fire on park rangers patrolling the park in airplanes.

Distrust and animosity for the park still run deep. Some park officials suggested that tensions have lessened considerably, citing that meetings with local residents see far fewer contentious issues than in previous years. Community member interviewees, however, responded that anger with park policies has not necessarily subsided; rather, people have simply realized that it is a "waste of energy" to engage the park on points of contention. Changes in administration have helped build bridges between the park and some local residents, particularly the arrival of a new superintendent who interviewees (both NPS staff and community members) characterized as taking local residents' concerns to heart. Other residents still feel that the park does not listen to their concerns about how park policies affect their way of life.

The place.

The "preserve" areas in WSEPP are typically more accessible than "park" lands, meaning closer to roads, but even the most accessible areas of WSEPP are difficult to access. Several local guides fly clients from all over the USA into the preserve to hunt moose, bear, and sheep (the NPS closed the season on caribou in the mid-1990s due to low population numbers). Alaskans from Anchorage and other

areas beyond the local region also come to the preserve to hunt. Many bring off-road vehicles (ORVs) with them to aid in accessing and transporting game.

This very large park contains only two roads that penetrate its interior, a 60-mile road to the old mining towns and historical site of Kennecott and McCarthy and a 46-mile road to the "town" of Nabesna (Map 5). Nabesna is little more than a few cabins belonging to one family and a grassy, or frozen, airstrip. Both of the interior roads are gravel. A highway snakes along the river that borders the northwestern section of the park. The road passes through several small towns and villages. The highway parallels the park for approximately 130 miles, but this is a modest portion of the park's total perimeter.

The area around the park is sparsely populated, with approximately 6,000 people living in the 13.2-million acre park's resident zone. I drove hundreds of miles some days to conduct interviews with key informants throughout the region. "Towns" are generally just clusters of a few houses and possibly one store. Buildings are so dispersed that addresses are given as mile markers on the highway. A few services are available in the larger municipalities such as Glennallen (population of 554 as of the 2000 census), but multiple interviewees told me that they drive the 200+ miles to Anchorage to stock up on supplies, even for groceries.

Census statistics are of little help in characterizing the population in the towns surrounding WSEPP. First, several residents live outside of incorporated areas. Second, the towns are quite distant from each other and vary accordingly in their characteristics. For example, while Glennallen has a 5% native Alaskan population, Yakutat is composed 47% by native Alaskans. In Slana, a mere 6% of the residents have postsecondary degrees, but 40% of the Glennallen residents do. Census data indicate that average income in most towns surrounding WSEPP is close to the

national average, but these data do not account for some extremely impoverished unincorporated areas.

The people.

At this study site, interviews with community members were primarily with individuals whose communities perceived them as leaders. Three of these people were members of the park's subsistence resource commission (SRC). The SRC consists of nine local rural residents representing geographic, cultural, and user diversity from the region surrounding WSEPP. The commission affords local subsistence users the opportunity to comment on and ask questions about the management of subsistence resources in WSEPP. The SRC recommends, to the Governor of Alaska and the Secretary of the Interior, regulations related to (a) animal harvest in the park, (b) use of cabins on park lands, and (c) collection of firewood, plants, antlers, and horns.

I attended a full-day biannual meeting of the SRC in addition to separately interviewing SRC members. I also spoke with three Native Alaskan (Ahtna) leaders. Additional interviewees from the community included two officials from the Alaska Department of Fish and Game and eight further local individuals or couples involved with issues related to wildlife.

The communities surrounding WSEPP are composed primarily of Native Alaskans (Athabaskan in the interior and Tlingit on the coast) and migrants from the lower 48 states, who are mostly Caucasian. A large percentage of the Ahtna people (the Native Athabaskan Alaskans in the Copper Basin) living near the park still rely on subsistence harvests to survive. Ahtna interviewees indicated that a fair number of the Ahtna people have supplemental employment. A substantial majority of non-Native Alaskans also engage in subsistence harvest activities, although most of these individuals have additional employment, according to the local residents I interviewed.

My interviews with individuals in the Copper Basin region (home to 3,300 of 6,000 the local residents) revealed the perspective that the local populace is, on average, highly conservative, politically and economically. Most local residents I spoke with indicated that their communities oppose large government, decry the interference of the federal government in their lives, advocate the status quo over change, and view the state government as a more legitimate source of authority than the federal government. It is important to note that I spoke with more migrants from the lower 48 states than with Native Alaskans. Some Alaska natives indicated more support for the federal government than the state government because of their villages having official relationships with the federal government, but not with Alaska. When stating local residents' grievances against the park, several Caucasian interviewees cited the state constitution, which provides dictates for how natural resources should be managed. In some cases, these dictates differ substantially from official NPS policies.

Living in a thinly populated place with such a harsh climate is a very conscious choice for the migrants from the contiguous 48 states. Nearly every translocated resident I interviewed mentioned that he or she moved to Alaska to partake in a lifestyle of freedom and self-reliance. The community members often indicated that individuals in their communities view the NPS restrictions as limiting their freedoms and making self-reliance more difficult.

The NPS employees who move to Alaska to work at WSEPP, by necessity, live in the local communities, and many engage in traditional subsistence activities such as hunting, trapping, and harvesting Copper River Salmon with a fish wheel. Nearly all the park employees are Caucasian, and due to the tendency for NPS employees to work at several units throughout their careers, many have not lived in the local communities for long. Interviews revealed that most NPS interviewees seemed

to have a good understanding of the local culture, but few exhibited the same fervor for living in a land of "freedom" and "self-reliance" that other community members displayed. The NPS employees seemed to share with the other local residents an intense joy of and respect for the natural world.

The problem.

At WSEPP, I examined risk perceptions about avian influenza. While local residents rely more on salmon and large terrestrial game than birds for subsistence, a number of subsistence waterfowl hunters (native Alaskans and Caucasian migrants) live in communities near the park. No agency has detected the H5N1 highly pathogenic strain of avian influenza (HPAI) in Alaska; however, the BRMD's wildlife health program suggested that I examine risk perceptions associated with HPAI in Alaska because of Alaska's proximity to Asia. HPAI has been detected in poultry, wild birds, and humans in Asia consistently since 2004. The disease has killed millions of wild birds and domesticated poultry in Asia, Africa, and Europe. The World Health Organization reports, however, that (as of June 2010) less than 500 people are known to have contracted the disease worldwide since H5N1 first emerged in Hong Kong in 1997 (www.who.int/csr/disease/avian_influenza/). Recent research has implicated wild birds in transmission of HPAI (Newman et al., 2009). Human health risks related to HPAI have been widely perceived, likely owing in part to the fact that 59% of all humans reported to be infected with HPAI have died.

The main perceived risk related to HPAI that emerged from my interviews at WSEPP was risk to human health from consumption of potentially infected birds. A few avid bird watchers identified the potential risk of HPAI leading to reductions in already declining migratory bird populations. People who were informed about HPAI obtained most of their information from the Internet or from the local Alaska Department of Fish and Game office. Word of mouth is an important information

source in the communities surrounding WSEPP, particularly for those people without access to the Internet. While archival research revealed that the Anchorage Daily News, the mostly commonly read daily newspaper in the study site, did report on HPAI during the first few years when the disease started generating international attention (2004-2006), interviewees did not identify this paper or any other newspaper as a central source of information at this study site. Several communities are too remote to have paper delivery and thus individuals would have to drive many miles to a local general store to purchase a newspaper. No interviewees cited radio or television as important information sources.

My interviewees generally opined that HPAI was of little concern to the vast majority of the local resident population because HPAI did not exist in Alaska and these residents were focused on other very real wildlife-associated risks. By far the most common risk perceptions my interviewees identified were related to a substantial decline in large megafauna in the park, particularly the decline in the Mentasta caribou herd. Interviewees reported that local community members perceived risks from (a) their inability to harvest caribou as a source of food, (b) the pressure that harvest restrictions on this herd placed on other herds outside the park, (c) the reduced genetic diversity in the herd, and (d) the potentially imminent loss of a genetically distinct herd.

Conclusion

The differences in demographics, culture, environmental/geographic setting, disease characteristics, NPS unit structure, societal response to the problem, etc. reviewed in this chapter only begin to highlight some of the many ways in which the situational contexts for each case potentially affected risk perceptions about and reactions to wildlife and vector-borne diseases. In the next chapter I discuss, and provide data to illustrate, how the contextual variables examined in this chapter helped

individuals in the study sites perceive and react to risks in certain ways. I identify overarching themes and specific factors that describe how individuals perceived risks related to each of the aforementioned problems.

Chapter Five: Factors Affecting Risk Perceptions

"Where the telescope ends, the microscope begins. Which of the two has the grander view?"

-- Victor Hugo (1802-1885), *Les Misérables*

The interview data reveal that numerous factors affect the ways in which NPS employees and the public perceived and reacted to risks related to wildlife and vector-borne diseases in the four cases. Several factors directly influenced risk perceptions or reactions. Additionally, many of them indirectly conditioned perceptions and reactions, by affecting other factors. In this chapter, I describe the twenty factors that emerged from the data and discuss connections between them.

Quotes from interviewees help to illustrate the factors; tables 2 and 3 provide metadata on the raw interview data used to identify them. Table 2 indicates the total number of interviewees from each case that cited each factor. Table 3 reveals the total number of instances in which interviewees from each case cited each factor (this total accounts for interviewees who mentioned a factor's affects on risk perceptions and/or reactions on multiple occasions over the course of the interview).

After identifying instances of each factor, I further organized these constructs by placing each one under one of two overarching themes: *expectations* and *tangibility*. While these themes are similar to established theories in some ways, the emergent factors, not existing theory, were used to identify the most appropriate theme headings. I offer the intersection of expectations and tangibility as a guiding framework for characterizing how risks were perceived and reacted to in the four cases. In line with the tenets of Grounded Theory, the themes (as well as the factors) are emergent. Many of these factors are well established in the literature reviewed in

chapter two, others are hinted at in that literature, and a few seem novel to that literature.

The Themes: Expectations and Tangibility

Expectations, broadly, are objects, events, actions, and/or attitudes that one expects. The Oxford English Dictionary provides two slightly different definitions for the verb "expect": (a) "to anticipate the occurrence of (something); to regard (an event) as about to happen" and (b) "to look for as due from another; to look for (something) with an implied injunction or requisition" (www.oed.com). The *expectations* theme refers to individuals' beliefs about risks they "look for as due" in a given context (e.g., when using or living near public lands). An example of this meaning of "expect" comes from Lord Horatio Nelson, who uttered, "England expects every man to do his duty!" Surely, Lord Nelson meant that England believes it *appropriate that* every man do his duty and not that England literally thought that every man would fulfill his obligation to the nation.

Tangibility refers to how noticeable and relevant a disease and its associated risks are. Factors within the theme of tangibility derive primarily from (a) the emergence of the disease and/or (b) the human perception of and response to the disease and its associated risks. The factors subsumed under tangibility are incumbent on the disease's emergence (not necessarily in a specific locale, but just in general). An individual, or population aggregately, may have expectations related to "wildlife disease" broadly (and not a specific disease in particular), but as the word tangible implies, for a disease to have tangibility, it must have certain perceived characteristics and not exist only in the abstract.

Table 2. Number of interviewees citing each factor

Factor*	***N*† SBDNL**	***N*† FINS**	***N*† GGNRA**	***N*† WSE**	**Definition**
Expectations					Descriptions of individuals' beliefs about the risks that they look for as due in a given context (e.g., on public lands)
Values	26	18	25	14	Statements about norms, ideals, or customs
Activities	21	4	5	13	Reference to actions that expose people to a disease and/or associated risks
Local cultural context	16	15	9	3	Descriptions of one's relation to the local landscape that affect his/her risk perceptions
Issue-attention cycle	3	5	10	2	Statements about a disease attracting differential attention over time
Part of life	2	12	6	2	Descriptions of people who came to view disease risks as something they simply had to deal with
Ubiquitous	2	10	2	1	Statements expressing the belief that a disease and/or vector are omnipresent in a given area
Voluntary	3	5	2	2	Statements on whether one can avoid exposure to risks or not
Blame	9	5	15	1	Statements ascribing fault for a disease to a particular entity
Trust	7	15	14	13	Historical and contemporary beliefs about whether an NPS unit or other risk management entity acts in the public's best interest or not
Community capacity	11	7	6	6	Comments on whether community members are united in risk perceptions or not, and contain institutions to address risks
Tangibility					Statements about the degree to which individuals perceive a disease and its associated risks as relevant and/or noticeable
Probability	3	15	16	6	Statements about the frequency with which people experience (or could experience) a disease and/or associated risks

Table 2 (continued).

Factor*	***N*†** **SBDNL**	***N*†** **FINS**	***N*†** **GGNRA**	***N*†** **WSE**	**Definition**
Visibility	19	12	13	9	Assertions about how readily *noticeable* a disease or its effects are in the landscape
Proximity	2	9	8	5	Perceptions of closeness and immediacy of a disease and/or its effects
Management actions	20	24	24	20	Statements about actions the NPS or another entity has taken (or has not taken, but "should" take) to limit risks
Quality of life	7	24	8	0	Comments about risks associated with a disease vector but not with the disease itself
Media coverage	16	10	17	3	Descriptions of information in the mass media about a disease and related risks
Ability to take action	11	18	19	9	Descriptions of actions one could take to prevent exposure to a disease and/or associated risks
Knowledge	15	12	20	19	Statements about the level and type of understanding people have about a disease and/or associated risks
Direct personal experience	6	8	6	3	Statements about the degree and nature of one's exposure to a disease and/or vector
Continuity of concern	4	2	10	1	Descriptions of the frequency with which people perceived risks over time

†*N* = the number of unique interviewees who mentioned the factor

***** The number of interviewees identified as having cited each factor only includes interviewees that made statements related to perception of risk associated with one of the diseases studied (i.e., Type E botulism, Lyme disease, West Nile Virus, or avian influenza). If an interviewee cited a factor, but not in relation to disease risks, that interviewee is not included in the totals in this table.

Table 3. Instances of factors in interview data

Factor*	***n*‡ SBDNL**	***n*‡ FINS**	***n*‡ GGNRA**	***N*‡ WSE**	**Definition**
Expectations					Descriptions of individuals' beliefs about the risks that they look for as due in a given context (e.g., on public lands)
Values	93	44	89	41	Statements about norms, ideals, or customs
Activities	41	12	12	29	Reference to actions that expose people to a disease and/or associated risks
Local cultural context	32	33	16	5	Descriptions of one's relation to the local landscape that affect his/her risk perceptions
Issue-attention cycle	4	8	12	3	Statements about a disease attracting differential attention over time
Part of life	2	16	7	2	Descriptions of people who came to view disease risks as something they simply had to deal with
Ubiquitous	2	12	3	1	Statements expressing the belief that a disease and/or vector are omnipresent in a given area
Voluntary	4	7	2	3	Statements on whether one can avoid exposure to risks or not
Blame	16	6	35	1	Statements ascribing fault for a disease to a particular entity
Trust	12	39	37	36	Historical and contemporary beliefs about whether an NPS unit or other risk management entity acts in the public's best interest or not
Community capacity	24	29	13	10	Comments on whether community members are united in risk perceptions or not, and contain institutions to address risks
Tangibility					Statements about the degree to which individuals perceive a disease and its associated risks as relevant and/or noticeable
Probability	4	25	29	7	Statements about the frequency with which people experience (or could experience) a disease and/or associated risks

Table 3 (continued).

Factor*	***n*** ** **SBDNL**	***n*** ** **FINS**	***n*** ** **GGNRA**	***n*** ** **WSE**	**Definition**
Visibility	71	26	22	14	Assertions about how readily *noticeable* a disease or its effects are in the landscape
Proximity	2	15	11	6	Perceptions of closeness and immediacy of a disease and/or its effects
Management actions	80	127	104	31	Statements about actions the NPS or another entity has taken (or has not taken, but "should" take) to limit risks
Quality of life	11	71	18	0	Comments about risks associated with a disease vector but not with the disease itself
Media coverage	36	13	27	5	Descriptions of information in the mass media about a disease and related risks
Ability to take action	28	36	37	12	Descriptions of actions one could take to prevent exposure to a disease and/or associated risks
Knowledge	37	26	63	47	Statements about the level and type of understanding people have about a disease and/or associated risks
Direct personal experience	11	10	7	6	Statements about the degree and nature of one's exposure to a disease and/or vector
Continuity of concern	5	2	15	1	Descriptions of the frequency with which people perceived risks over time

‡ *n* = the number of unique instances in which an interviewee mentioned the factor

***** Instances of each factor only include material from interview transcripts related to perception of risk associated with one of the diseases studied (i.e., Type E botulism, Lyme disease, West Nile Virus, or avian influenza). If an interviewee cited a factor, but not in relation to disease risks, that material was not coded.

Table 4. Generalized anticipated effects of each factor on risk perceptions

Factor*	**Expected effect on risk perceptions**
Expectations	
Values	Types[a], inc. magnitude[b] for risks related to values, dec. magnitude[c] for risks unrelated to values
Activities	Types[a], inc. magnitude[b] for risks related to activities, dec. magnitude[c] for risks unrelated to activities
Local cultural context	Types[a], inc. magnitude[b] for risks novel to context, dec. magnitude[c] for risks known within context
Issue-attention cycle	Inc. magnitude[b] for recently emergent risks, dec. magnitude[c] for established risks
Part of life	Inc. magnitude[b] for risks not considered part of life, dec. magnitude[c] for risks considered part of life
Ubiquitous	Inc. magnitude[b] for risks perceived as locally present but rare in other locations, dec. magnitude[c] for risks perceived as ubiquitous
Voluntary	Inc. magnitude[b] for risks perceived as involuntary, dec. magnitude[c] for risks viewed as voluntary
Blame	Types[a], inc. magnitude[b] if entity identified as responsible for risk(s) is not perceived as competent, dec. magnitude[c] if entity identified as responsible for risk(s) is perceived as competent
Trust	Inc. magnitude[b] for risks managed by entities one does not trust, dec. magnitude[c] for risks managed by entities one trusts
Community capacity	Types[a], inc. magnitude[b] if capacity is high but the risk is difficult to manage, or if capacity is low (leading to lack of coordination), dec. magnitude[c] if capacity is high and the risk is able to be managed
Tangibility	
Probability	Inc. magnitude[b] for risks with high perceived probability of affecting an individual or something about which that individual cares, dec. magnitude[c] for risks with low probability
Visibility	Inc. magnitude[b] for risks with highly perceptible effects and/or vectors, dec. magnitude[c] for risks that are not directly apparent to one's senses

Table 4 (continued).

Factor*	**Expected effect on risk perceptions**
Proximity	Inc. magnitude[b] for risks perceived as existing close to where one lives, dec. magnitude[c] for risks perceived as existing only in distant locations
Management actions	Types[a], inc. magnitude[b] for risks not managed to expectations, dec. magnitude[c] for risks managed to expectations
Quality of life	Types[a], inc. magnitude[b] if there are quality of life concerns that one can link to a disease or vector, dec. magnitude[c] for risks without related quality of life concerns
Media coverage	Types[a], inc. magnitude[b] for risks covered heavily in media, framed as substantial threats, and/or lacking good scientific and/or efficacy information, dec. magnitude[c] for risks neglected in media, framed as non-issues, and/or covered with good scientific and/or efficacy information
Ability to take action	Inc. magnitude[b] if little perceived ability to prevent exposure to the risk, dec. magnitude[c] if high perceived self and response efficacy
Knowledge	Low to moderate levels of knowledge about a disease and associated risks seem to correlate with risk perceptions of the greatest magnitude; thus, inc. magnitude[b] if knowledge increases from none or little to a still limited amount of knowledge, dec. magnitude[c] if the cumulative total of knowledge is more than moderate
Direct personal experience	Types[a], inc. magnitude[b] if experience increases visibility or relates to values, dec. magnitude[c] if experience increases knowledge substantially or conditions a "part of life" view; experience could also lead to heuristic activation, which could increase or decrease magnitude
Continuity of concern	Inc. magnitude[b] for continuously present risks or risks that appear with regular frequency, dec. magnitude[c] for uncommon and sporadically present risks

[a] Types = these factors condition the types of risks individuals (or populations on the aggregate) perceive
[b] Inc. magnitude = the presence of these factors is expected to increase the magnitude of risk perceptions
[c] Dec. magnitude = the presence of these factors is expected to decrease the magnitude of risk perceptions

In the remainder of this chapter, I chronicle each distinct factor explaining individuals' perceptions and/or reactions to risks in the four cases (related to Lyme disease, West Nile Virus, Type E botulism, and avian influenza). The factor names appear in **bold** text. The text of this chapter explains how each factor relates to expectations and/or tangibility, how the factors relate to each other, and the ways in which the factors affected risk perceptions and reactions. Table 4 concisely synthesizes the major effects each factor had on risk perceptions. This table only lists whether a factor affected types and/or magnitude of risk perceptions. The nuance of how these effects occurred in each case is discussed in the text. Table 4 does not include risk reactions. While the data from the interviews provides evidence that nearly all factors affected perceptions *and* reactions, it is not possible to reduce risk reactions to a few general trends because the reactions were too context specific.

To avoid merely listing the factors, I provide a narrative that demonstrates some of the most notable linkages between factors; one should not construe this as suggesting that the connections I make explicit are the only relationships between factors. Within the spatial constraints presented here, I identify several important connections, but there are certainly additional links that I do not recognize explicitly.

Expectations.

Values (i.e., the norms, ideals, and customs that one strongly adheres to and uses to define oneself)[2] emerged as one of the factors interviewees cited most as contributing to risk perceptions and reactions (Tables 2 and 3). This factor also had a predominant influence on expectations. The interviewees provided numerous examples of how values conditioned (a) level of tolerance for diseases, (b) reasons for being concerned about diseases [e.g., human health, economic, or aesthetic concerns],

[2] www.dictionary.com; this website provides a definition that more closely mirrors (and is more accessible than) the every day meaning of "values" than definitions from particular academic disciplines. I sought to characterize "values" in line with the way my interviewees would define and understand this construct.

(c) conceptions of whether diseases "should" exist in a given natural area, (d) beliefs about who is to blame, and (e) beliefs about what should be done to address risk(s).

Values often predisposed individuals to expect particular types and magnitudes of risk. For example, at Sleeping Bear Dunes National Lakeshore (SBDNL) and Golden Gate National Recreation Area (GGNRA), fervor for engaging with and protecting the environment conditioned sub-populations to express passionate concern for wildlife and ecosystem health when diseases and disease management threatened environmental well being. While values are obviously characteristics of individuals, the interview data suggest that at some study sites, acceptance of certain values was influenced by the cultural and social context. This finding is consistent with the cultural theory of risk (Douglas & Wildavsky, 1982) research on cultural cognition (Kahan et al., 2009; Slovic et al., 2000), and the social contagion theory of risk (Scherer & Cho, 2003).

Multiple interviewees indicated that a large group of local residents who visited and used GGNRA were more concerned about pesticides (used to control disease vectors) than about threats from Lyme disease or West Nile Virus. Interviewees cited a local perception that pesticides were not natural components of the landscape. Because, in the minds of numerous local residents, the means for controlling a potential threat posed more risks than it alleviated, this seemed to attenuate concerns about vector-borne diseases in areas of Marin County, CA. A public health officer near GGNRA explained,

> The related issue is, 'how do you control mosquitoes in a way that is safe for the public?' Marin County is a very progressive part of the country, and there is a *very strong environmental presence* in the county [emphasis original]. Certain communities worked closely with the vector control district to put

measures into place that address these concerns people have raised about exposure to pesticides.

The health officer's account reveals how the effect of values on expectations not only affected risk perceptions but also led to demonstrable risk reactions.

At SBDNL, interviewees agreed that the environmental proclivities of local residents readied many individuals to notice and care about the death of charismatic bird species as well as the overall effects of Type E botulism on the Great Lakes ecosystem. Even after local residents learned that there were no human health risks related to the outbreak, substantial local interest and engagement in the botulism issue remained. A Traverse City newspaper journalist commented,

> I think it is just an overall concern for the environment. You know, people don't live here because the wages are great – people live here because they get to be a part of the natural environment. You don't have to drive very far in any direction to be completely lost in the woods. You don't have to drive very far in any direction to find a beautiful lake or stream and you know, that's why people live here and they wouldn't live here if they didn't care about the environment – so, I wouldn't expect them to lose interest in any environmental issue.

This quote reveals that values may affect not only the types of concerns individuals have, but also the duration over which those concerns are relevant. These risk perceptions also led to a mobilization of some residents to monitor for the effects of botulism on local beaches. Thus, we observe that expectations (e.g., the expectation of interacting with a beautiful and pristine natural environment) may affect tangibility through risk perceptions and risk reactions.

I observed that values affected the types of **activities** that individuals regularly engage in (and vice versa); in each case, activities served as a manifestation of values.

Activities that individuals engage in prior to the emergence of a disease can establish familiarity with an environment and create expectations for what is "normal" there. Activities could also reinforce values and foster a sense of place. An NGO leader near SBDNL commented, "I moved here five years ago from Indiana, and the level of awareness here for environmental issues is much higher – I worked on similar watershed issues there for 19 years. People [here] spend so much time outside exposed to the resources." This interviewee reveals that activities can affect the level of knowledge one has, allowing one to place an emergent risk within context.

At Wrangell-St. Elias Park and Preserve (WSEPP), whether an individual hunted waterfowl or not was one factor affecting risk perceptions and reactions associated with avian influenza. A law enforcement ranger stationed at WSEPP mentioned,

> No one's even expressed anything to me here [about concerns related to avian influenza] at all compared to the coast [on the Bering Sea]. I was out on the northwest coast [of Alaska], and [avian influenza] was such a huge thing, because it was such a big part of their diet: sandhill cranes, trumpeter swans, auklets, all of the sea ducks.

This ranger illustrated differences in risk perceptions between two groups of people who engaged in different activities, in part, because of their different cultural practices. The people who had little expectation of interacting with waterfowl, due to their activities, perceived less risk than everyday waterfowl hunters did.

After a disease emerges, activities people commonly participate in can expose individuals to risks that they may not otherwise experience. Activities may help people understand a risk differently from people who do not experience a risk so directly. This aspect of the activities in which one engages relates closely to the

tangibility theme and the "direct experience" and "visibility" factors contained therein (I discuss the relevance of activities to these factors in the section on tangibility).

Both of the foregoing quotes about activities also identify the potential importance of the **local cultural context** in which one has lived and lives currently. The interviewees indicated that local cultural context in Indiana versus northern Michigan and the Bering Coast versus inland Alaska prepared local residents to select different types of risks as relevant. While values and activities can certainly be part of the local cultural context, here I refer to systematic differences in risk perceptions and reactions reported by interviewees between (a) urbanites versus rural residents, (b) local residents versus other park users, (c) permanent versus seasonal residents, and (d) individuals who live in the same town but who previously lived in different regions. Multiple interviews (the majority of interviewees at FINS and SBDNL; see Table 3) revealed instances in which local cultural context affected risk perceptions and reactions.

The cultural theory of risk (Douglas & Wildavsky, 1982) and comprehensive frameworks such as the SARF (Kasperson et al., 2003) both identify the importance of an individual's placement within society as a factor affecting risk perceptions. An example from the interview data comes from a law enforcement ranger at SBDNL: "Visitors are often very much urban people; they do not know how to handle themselves in a natural area with environmental risks." This ranger of many years related how urban dwellers often reacted differently than rural residents to risks, particularly with reference to handling bird carcasses more carelessly and reporting dead birds to rangers with greater fear and urgency than rural residents.

At Fire Island National Seashore (FINS), sub-populations coming from different cultural contexts had divergent expectations on the aggregate. While several permanent local residents professed an intense connection to the animals, plants, and

ecosystems of Fire Island, a community leader indicated that seasonal residents and renters paid less attention to the biotic aspects of the Island:

> People here come from Manhattan, or wherever, and they just think about it as coming to their beach house on Fire Island. The bay is on one side, the ocean is on the other, and the restaurants are in town. It is a place to sun, surf, and enjoy the summers.

Many interviewees characterized those with little understanding of the natural environment as knowing little about natural threats to which they could be exposed. A maintenance worker at FINS further described how the communities and cultures from which an individual comes influence expectations,

> If you go [to Fire Island] knowing that its full of ticks and mosquitoes, then it's not a problem, but if somebody's girlfriend from The City gets talked into going to the casino [a restaurant/bar] for the evening and she has no clue, and she's dumped out there with the mosquitoes and ticks, she is not having a very good time.

These quotes show that expectations for exposure to diseases and vectors can lead to variability in the magnitude of risks individuals perceive, and can affect the physical actions one takes to prepare for dealing with disease. Interviewees frequently described less variability in the magnitude of perceived risk in populations that were well informed about a disease and associated risks, compared with populations lacking knowledge of the disease. NPS employees were identified regularly as the most knowledgeable population, followed by local residents, and then other members of the public.

The foregoing quotes that touch on local cultural context also indicate that as a disease gains tenure in a given location, expectations for how people will experience that disease and its vectors may change. Expectations proceed from cultural and

experiential background, but also from a history of exposure (direct or vicarious) to a risk. Interviewees across the cases indicated that people direct their attention to the effects of disease for a limited amount of time (e.g., a couple of years, months, or even weeks), and then their interest and attention to those risks subsides. Interviewees from multiple cases referred to this phenomenon as an instance of "disease du jour." This phenomenon is similar to the **issue-attention cycle** that Anthony Downs (1972) used to describe the waxing and waning of mass media coverage of newsworthy topics.

The issue-attention cycle influenced expectations and/or tangibility in several ways: (a) a new, fresh risk (from a disease or otherwise) drew attention away from an older, less novel disease risk, (b) mass media outlets declined in their coverage of a disease, and (c) people realized that they could do little to mitigate the effects of the disease. In each circumstance, individuals began to perceive that the risks were no longer relevant, or simply to accept them as part of the expected future in their locale. An engaged resident in Marin County described how Lyme disease might fit into the issue-attention cycle for some residents near GGNRA.

> People in this area need to have a current complaint, Lyme falls into this category. Not long ago it was 'chronic fatigue syndrome,' now some people associate this with Lyme disease. People here subscribe to the 'disease of the month club.' There is some truth in the diseases that people cite, but people in this area are also hypochondriacs."

This resident reveals that some community members may currently find risks associated with Lyme disease highly relevant and they may expect that this disease will affect them seriously. The quote also imparts a belief that relevance and expectations will soon change.

As diseases passed through the issue-attention cycle and became less novel, some interviewees believed that people started paying the disease less attention and/or

started to accept its presence. Several interviewees affirmed that as individuals became familiar with a disease and were exposed to it consistently, some NPS staff and community members would identify the disease simply as **part of life**. Interviewees indicated that as a disease increased in spatial and temporal presence, as well as incidence and prevalence, some individuals would identify the disease as something they could not avoid and simply needed to accept.

The data indicate that those who harbored the expectation of encountering and having to deal with certain risks exhibited lower magnitudes of risk perceptions compared to those who did not accept the disease as part of life, all else held equal. A comment from a park administrator at FINS helps to explain:

> There are two schools of thought. There is the disgruntled employee that is sick of the mosquitoes; they may complain to visitors and ask them to call the Superintendent and say 'this is crap that we have to work in these conditions and that you have to visit in them.' Others realize that it is something you have to put up with. If you don't like the weather, move; if you can't deal with it, you can quit.

An employee at GGNRA alleged that individuals at the Recreation Area generally perceived nominal risk related to Lyme disease because many consider it part of life,

> "I think it's more like [park employees and volunteers] know [Lyme disease] is something they have to deal with, and they deal with it…They have the tick nippers; they have the Permethrin; they have all the safety stuff they would need out in the field with them."

At both FINS and GGNRA, interviewees indicated that people seemed to perceive disease risks as part of life when a disease became omnipresent, spatially and temporally. When individuals no longer perceived a disease as novel and localized,

but as **ubiquitous**, interviewees indicated that the magnitude of perceived risk generally declined. Interviewees explained that individuals who perceived a disease as ubiquitous also held expectations that they would regularly interact with the disease, its vector, or its effects.

An employee at FINS's William Floyd Estate observed, "Because ticks are all over Long Island, there may not be a one-to-one correlation that 'I went to [the William Floyd Estate] and I have thirty ticks', because you can get them in your backyard." This quote shows how ubiquitousness contributed to acceptance of ticks and Lyme disease at FINS; people became less concerned when they did not perceive the disease as something unique to the Seashore. A law enforcement ranger at FINS confirmed this observation with respect to Fire Island proper, "West Nile is now just on the concern list and is no longer the issue du jour… [Lyme disease] was also an issue du jour back then, but then people realized that ticks are everywhere and not just on Fire Island." A staff member for a Marin County politician additionally observed that ubiquitousness of Lyme disease may affect local resident risk perceptions; "I would say the understanding is that [Lyme disease is] everywhere. It's around our homes; it's on all our hills; it's on the ag[ricultural] lands; it's in county open space; it's in the state parks."

The degree to which an individual perceived a disease and its associated risks as part of life and ubiquitous seemed to contribute to perceptions of the degree to which a risk was **voluntary**. While not a commonly cited factor (Tables 2 and 3), a few interviewees mentioned instances in which perceptions of voluntarily versus involuntarily experienced risk substantially affected the magnitude of risk perceptions and types of risk reactions. Perceptions of voluntariness were cited as an important factor in the foundational work in risk perception theory. In 1969, Chauncey Starr

helped establish the field of risk analysis when he published evidence that individuals are 1,000 times more likely to accept voluntary risks compared with involuntary risks.

As individuals (or populations aggregately) perceived diseases and their effects as increasingly present, interviewees indicated that some of these people also started characterizing the associated risks as threats they exposed themselves to by choice (e.g., one chooses to live on Fire Island, ticks with Lyme disease also live on Fire Island, therefore choosing to live there means choosing likely exposure to Lyme disease). Other individuals vehemently resisted the belief that they had any option regarding their exposure to the risks. Even some individuals who identified a risk as part of life (accepting that they would necessarily interact with the risk) still perceived the risk as involuntary. Perceptions of risks as involuntary portended the expectation that one should not have to be exposed to a risk. Voluntary risks presaged expectations that exposure is simply a condition of one's choices.

My interview data reveal that several residents at FINS viewed the effects associated with Lyme disease as involuntary risks, while other residents and the vast majority of the NPS employees there perceived them to be voluntary risks. A natural resources manager at FINS commented, "You can avoid exposure to ticks and Lyme disease on Fire Island. You have to go into the tick habitat to expose yourself to ticks. Why should people be so concerned about it?" Contrast this statement with the reflection of an employee from Robert Moses State Park (also on Fire Island), "My main concern is for the staff out there in areas where they are exposed to ticks, but the ticks are everywhere, even in the concrete toll booths." Different beliefs about ability to limit exposure to ticks could affect perceptions of whether a disease and its associated risks are voluntary or not. The sub-population who perceived Lyme disease as involuntary was the same group that fought hardest for introduction of the 4-poster devices to reduce the number of ticks on the Island.

None of the other diseases in this study were characterized by the interviewees as posing involuntary human health risks. At SBDNL, interviewees revealed that experience of the *effects* of Type E botulism may be involuntary for some people. A maintenance worker for the National Lakeshore explained, "Leelanau County is aware [of the botulism issue] due to its small population and so much beach. The population is well-acquainted with the beach front; it is major part of their daily lives." Many local residents near SBDNL love walking the beaches and consider this activity central to who they are. Encountering dead birds on a walk seemed to be an involuntary risk to some; it could not be avoided.

An administrator at the National Lakeshore commented, "The commonplace reaction is the visceral reaction that it is gross that [local residents] cannot take their daily walk down the beach with their dog anymore without seeing lots of dead things." The involuntary nature of finding dead birds (both an aesthetic and emotional attack) may have contributed to an increase in the expectation that botulism is a serious issue that continually affects the lakeshore. Interviewees indicated that the expectation that dead birds could continually wash up on shore encouraged some local residents to become involved with monitoring the beaches for bird carcasses, an activity that NGOs and the NPS suggested local residents could do to help address the botulism issue.

In situations where risks were perceived as involuntary, I found that individuals across cases tended to attribute responsibility for exposure to the risk to another entity. Interviewees explained how they (and others they interacted with in the local community) viewed their exposure to a risk as the consequence of someone of some group of people failing to do their job properly. Whom people **blame** for the risks they associate with a disease can have large implications for risk perceptions, reactions, and risk communication. Cultural/social theories of

risk acknowledge the role that blame, or attribution of responsibility, can play in the formation of risk perceptions (Douglas, 1992; Beck, 1999). A resource manager at a FINS historical site explained this role, "The expectation of the visitors—many people that go to historic houses are older folks—is not to encounter this type of problem [with ticks]; they want to know why we [the NPS personnel] aren't doing more."

Residents and the mass media near GGNRA blamed a different entity for the risks related to Lyme disease. One local resident near GGNRA synthesized the local perceptions well when she opined, "I don't think that I can blame the park service if I get bit by a tick in the park. In that movie I told you about, 'Under Our Skin', it is really against the medical establishment." A filmmaker from Marin County produced a nationally screened film that buttressed several residents' beliefs that, "A lot of people have [Lyme disease] and are not diagnosed, are not diagnosed correctly, or are not treated."

The foregoing quotes reveal that blame attribution can foster expectations for management. A staff member for a county supervisor in Marin County described local perceptions, "There isn't a sense that ticks and Lyme disease can be managed in some manner, so as it relates to park service and park management, people don't say the park service needs to get rid of ticks, they know the park service can't do that." Expectations for management also derive from the level of **trust** that an individual places in the entity that is responsible for managing the disease and associated risks. Risk perception researchers have consistently identified trust as a factor that conditions risk perceptions broadly, and particularly with respect to environmental risks (Slovic, 1992; Slovic et al., 2000; Leiserowitz, 2006).

Tables 2 and 3 indicate that trust was cited commonly as a factor affecting risk perceptions and reactions at each study site. The trust that affected risk perceptions

arose both from historical interactions with a risk management entity (in this case, the NPS unit) as well as interactions with the NPS unit regarding the specific disease issue. Trust in an NPS unit based on historical interactions often formed a backdrop for how interviewees discussed issues of trust related to a current issue (e.g., "this is just another example of [how the NPS unit behaved previously]").

NPS staff and community member interviewees in communities surrounding SBDNL and GGNRA stated that the local communities had generally positive relations with the park and high levels of trust in park administration. They expressed confidence that the NPS would do all that it could to address the risks associated with wildlife and vector-borne diseases. These expectations likely contributed to a reduction in magnitude of local residents' risk perceptions over what they may have otherwise experienced. In segments of the populations living in and near WSEPP and FINS, a history of tension and mistrust with NPS administration on issues unrelated to wildlife disease led to increased concern about risks local residents perceived in the NPS units. For example, a municipal official from a FINS community reflected,

> There is a perception amongst residents that the Seashore does not prioritize the health of human residents on the Island as they should, opposed to non-human residents. This sentiment is strong in some segments of the community; it is reflected in the response to the mosquito and tick control policies of the Seashore. There is definitely a lack of trust.

This quote establishes that some residents do not expect FINS to act in their best interest, conditioning risk perceptions and reactions.

Compare the lack of trust at FINS with the comments of a natural resources manager at GGNRA, "It is nice working for an agency where you receive some public respect. Most communities here have a fairly good relationship with the

park; we hold a lot of public meetings and reach out to them." Another resource manager at GGNRA confirmed these sentiments,

> Ultimately, if you bring all the groups to the table, you will be able to work out a compromise unless one group is asking for something egregious. Talking to them and dialoguing with them makes the difference; we generally all leave the table happy.

At GGNRA, the expectation seemed to be that NPS-community exchanges would be cordial and lead to mutually agreeable outcomes.

At WSEPP, a historically rooted distrust of the NPS did not seem to affect risk perceptions or reactions related to avian influenza. It is notable, however, that not one interviewee cited the NPS as (a) an important source of information about avian influenza or (b) a relevant entity for management of it. Local residents and NPS employees identified the US Fish and Wildlife Service and the Alaska Department of Fish and Game as the agencies they relied on for information about avian influenza; interviewees indicated that these agencies benefit from high levels of trust in the communities of eastern Alaska. Other wildlife issues in the park, for which the NPS was the primary source of information and management, were clearly complicated by a lack of trust. More than three-quarters of the community members I interviewed in WSEPP relied on culturally engrained feelings of mistrust to explain why the NPS was doing a poor job of managing wildlife resources (particularly caribou populations).

Beliefs about whether a risk management entity would meet one's expectations for management (including the physical response, communication, and transparency) was one important form of trust with potential to affect risk perceptions. Data from SBDNL and FINS reveal that one's trust in fellow community members to respond effectively to a risk, or **community capacity**, also influenced risk perceptions.

Cultural theory's emphasis on levels of hierarchy and collective control (or "grid" and "group") as organizing social principles affecting risk perceptions suggests that community capacity may play an important role in conditioning perceptions. Based on the low levels of grid and group (i.e., egalitarian self-sufficiency) in many Fire Island communities, cultural theory would predict an individualistic society that refuses to acknowledge environmental risks in an effort to protect private interests (Douglas & Wildavsky, 1982; Kahan, 2009). This certainly seemed to be the case, based on the interviews. The low grid and high group in the communities surrounding SBDNL would lead cultural theory to predict that these communities would caution toward fear of an environmental catastrophe. The interviewees reported that this was true for some individuals and many others tended in this direction, with deep-rooted environmental concerns related to the botulism outbreak.

At SBDNL, the local communities were able to come together quickly and present a unified vision for how to deal with the issue of botulism. Significant capacity (i.e., high group), in terms of multiple NGOs that were eager to work with each other, also helped in this respect. On Fire Island, the separation of the Island into several distinct communities, each with its own approach to handling risks from Lyme disease, likely contributed to low community capacity (i.e., low group). The separation of individual Fire Island communities into permanent residents, seasonal residents, seasonal renters, and weekly or weekend renters further reduced capacity. A community leader on Fire Island explained,

> Some residents say that there is an identifiable health risk, so every measure should be taken [to control ticks], but others say that the issue is over-blown and that [the NPS] do[es] not need to dump chemicals into the environment. Ticks and deer is thus a more political issue; the mosquitoes issue is more straight forward –

mosquitoes breed in the water; we have water; therefore, we identify actions to control the issue.

Interviewees indicated that the much greater community capacity near SBDNL seemed to produce expectations that the community could work together to address the problem. An employee of an NGO in northern Michigan reported,

> One of the really great things about this area and about the nonprofit environmental organizations is we all share information very well. We all use each other's expertise; if there is something that the Dunes do very well, we rely on them to do that and to share their information and keep everybody in this community knowing what is going on and understanding why.

This official understood that she could expect assistance from other local organizations and that they could expect the same from her NGO.

The ten aforementioned factors reveal that one's cultural experiences, one's community, local institutions, and one's personal decisions and experiences can condition expectations for how one will interact with a risk before that risk even emerges. These factors also suggest the importance of one's history of experience with a disease in leading to the recalibration of expectations. Factors more closely linked to individual and societal responses to a risk can build off these expectations to generate opinions about whether a risk is tangible or not.

Tangibility.

As the perceived **probability** of exposure to a risk increases, individuals increasingly view the risk as a tangible reality; risk perceptions often increase as well. This relationship is grounded in psychometric theories of risk perception (Slovic, 1987) and was quite evident in the interview data. A law enforcement ranger at GGNRA provided an example,

> All the discussion that I have heard about Lyme disease comes from the [NPS] staff that are out in the field all the time; constantly on trails and in the backcountry. I have never heard concern from the public directly. … Park employees are more concerned about Lyme disease than members of the public are, because the rangers are more exposed to it.

A member of GGNRA's natural resource staff used scientific information to back up the ranger's experiential observation; "Concern might be less out here because Lyme disease is not nearly as prevalent here as on the east coast. About three to five percent of adult ticks test positive for Lyme." This quote reveals that the perceived and actual probability of contracting Lyme disease is low for most people living near GGNRA. While prevalence data can only inform risk perceptions if individuals are aware of the scientific information, interviewees in the GGNRA area conveyed that public awareness of Lyme disease prevalence in ticks might actually be rather high, compared to the general population of the state or nation, due to the presence of a highly educated population in Marin County.

Prevalence of a disease or vector seemed to undergird perceptions of probability of risks associated with that disease. Where diseases were more prevalent (e.g., Lyme disease at FINS compared to Lyme disease at GGNRA), interviewees cited risks associated with a disease more readily. A local resident at FINS linked prevalence and probability to tangibility; "People were really freaked about ticks. West Nile Virus is abstract; Lyme disease is very real. On the Island it is impossible not to pick up ticks and I have been treated for Lyme disease three times."

The interview data demonstrate that probability and **visibility** are related closely. At SBDNL, as botulism outbreaks intensified, increasing numbers of bird carcasses littered the beaches, enlarging the probability with which individuals would see them. Many local residents (but few non-local visitors to SBDNL) walk the

beaches during the late summer and autumn, when the effects of botulism are most visible. A natural resource manager at SBDNL recalled, "There was nice weather those autumns [of 2006 and 2007], so everyone was out walking the shoreline. When you see 30-40 [dead birds] that really impacts you."

While beach walking at SBDNL equipped local residents to perceive botulism's effects as noticeable and relevant, common activities among locals at GGNRA, such as mountain bike riding, hiking, and trail running, contributed to some individuals' perceptions that Lyme disease and ticks did not pose a tangible risk. Because the probability of encountering a tick is much lower on the west coast, compared to the east coast, outdoor enthusiasts could be outside for hours and not see a tick. By being able to avoid ticks while exercising and recreating, interviewees surmised that perceptions of personal risk lowered for some local residents.

Visibility additionally affected risk perceptions independent of this factor's association with probability. If a sight, sound, or smell was particularly difficult to bear, or left a lasting emotional impression on an individual, the observation sometimes made the effects of the disease more emotionally tangible. For example, a park administrator at SBDNL observed,

> Reading about the [bird] deaths and seeing them is a very different thing. To see the sick animal or the death prompts a basic response. … You know, when it's a loon or a bald eagle, that's what really gets people. It's bad to see all the other birds, but when it's a loon or a bald eagle, that's a big deal.

This administrator reveals that the nature of the effects of the disease can prompt risk perceptions and reactions by affecting the disease's relevance to things about which people care. The quote demonstrates an impression, confirmed by many other interviewees, that the charismatic and/or iconic nature of the species affected by a disease can increase tangibility.

Low probability and low visibility associated with avian influenza in WSEPP seemed to be the primary reason for insignificant perceptions of tangibility, and hence might have conditioned local residents to display little concern about the disease. People were not finding dead birds near the park that could have led them to suspect avian influenza. Additionally, large numbers of birds are only a transient aspect of the landscape; because many birds only migrate through the park and do not spend their summers around WSEPP, disease vector is not regularly present to invoke potential risk perceptions or reactions. Without any reason to assume that one could acquire the disease and without observing any physical evidence of the disease, avian influenza was not a tangible risk for most individuals in communities near WSEPP.

Several local residents perceived little to no possibility of being exposed to avian influenza, due to perceptions of the disease's lack of **proximity**. A visitor-use assistant at the park commented,

> Alaska [Department of Fish and Game] continually samples from birds they collect and from harvests of waterfowl hunters, but nothing has been found here in Alaska … If I heard something that made me a little more leery about it, I may change my mind about wanting to waterfowl hunt, but my wife and I enjoy eating duck; it is something different.

The WSEPP employee reveals that proximity is an important aspect of probability, which is a key factor affecting perceptions of tangibility. This quote also makes explicit that knowledge of management actions can affect responses to a risk (both behavioral and in terms of beliefs).

Management actions can be proactive, as in the monitoring for avian influenza in Alaska, or they can emerge in response to a risk. A natural resource manager at GGNRA spoke to the virtues of proactive management, "There was some concern that rehabilitated wetlands may prove to be breeding grounds for mosquitoes.

We approved provisions for treating for mosquitoes in the wetlands if it's deemed necessary. We tried to anticipate complaints before the issue became a problem." NPS and community member interviewees at GGNRA described how proactive management helped local residents trust that the Recreation Area would do all that it could to protect them from future risks and that it would effectively manage those risks when they emerge.

Proactive management, therefore, affected expectations across the cases (as discussed in the preceding section); management after a disease and its associated risks emerged affected tangibility. For example, at SBDNL, the National Lakeshore's initial reluctance to undertake management actions that members of the public requested (i.e., removing bird carcasses from the beaches) made the effects of the disease much more visible than when SBDNL later opted to manage the bird deaths in this way. Tangibility was also accentuated because people who only cared about the effects of botulism for aesthetic reasons expressed much more concern when the birds littered the beaches than they did once SBDNL started removing carcasses. At FINS, the NPS's disinclination to manage ticks made Lyme disease more tangible as segments of the population viewed the absent management as a reason for substantial human health concerns. Increased tangibility affected the types *and* magnitudes of risk perceptions (types at SBDNL and magnitudes at FINS). The SARF (Kasperson et al., 2003) supports the finding that management actions can affect risk perceptions, by identifying the important role played by messages disseminated and actions taken by societal organizations and institutions.

Management can come from the NPS or another governmental or non-governmental entity. In the four cases, a single entity's management of a disease and its associated risks, typically lowered tangibility, by making the effects of the disease less noticeable and/or relevant (e.g., burying bird carcasses at SBDNL). Different

responses from multiple management agencies, however, occasionally contributed to an increase in tangibility of certain risks, or fostered perceptions of additional risks. Trust periodically became a factor. For example, at FINS, the county vector control district would spray for mosquitoes in towns on Fire Island, but the National Seashore would not spray in the natural areas surrounding the towns. A law enforcement ranger at FINS reflected, "People are confused about how the park will manage the problem, because they do not understand the park ideology and why we won't spray [for mosquitoes]." Some residents simply observe the vector control district helping combat the mosquito problem and the NPS doing nothing to address the issue. A local politician expanded on this conflict, "Spraying [for mosquitoes in communities on and near Fire Island] often seems futile when Fire Island [National Seashore] does not spray, because the perception is that you are just chasing them away."

In addition to actual management actions taken, individuals' perceptions of the *ability* and *willingness* of the NPS to manage disease risks emerged from the data as components of management affecting tangibility. At GGNRA, no agency did anything to manage tick populations, and while some individuals seemed concerned that doctors could not do more to treat the disease, no interviewee indicated that anyone was concerned about *ticks* not being managed. Several interviewees stated that no one was concerned about the lack of management because there was no expectation that ticks would be managed; the public generally considered physical management of ticks to be unrealistic. Therefore, zero NPS management of ticks at GGNRA did not enhance tangibility, due to expectations. At FINS, nominal physical management of ticks took place at the Seashore, but the public reacted differently. A substantial sub-population became upset, because these individuals held the expectation that installation of "4-poster devices," would help to control the tick population, and that FINS could and should take this action. Expectations inconsistent

with realized management amplified tangibility in addition to amplifying risk perceptions and reactions.

A natural resources manager at SBDNL described how beliefs about an agency's *ability* and *willingness* to manage a risk affected noticeability and relevance at the National Lakeshore: "The visitors were sometimes upset about the dead birds on the beach; they wanted the beaches cleaned due to the visual impact on their experience. … No one was angry about the park not managing the issue beyond cleaning the beach, *because the park really could not do anything else* (emphasis added)." The first sentence in this quote points to increased noticeability due to SBDNL's unwillingness to undertake viable management; the second sentence reflects that there was no escalation in relevance when the public had no expectations of further management.

This foregoing quote reveals that individuals can perceive risks associated with the effects of a disease that stretch well beyond the health risks that may commonly come to mind when considering diseases. At SBDNL, multiple NPS interviewees indicated that the only concern they heard from non-local visitors was the aesthetic complaint of seeing dead birds, which diminished their recreational experience. While the dead birds were an effect of botulism, and thus directly related to the disease, in other study sites individuals linked diseases to the disease vectors and expressed concerns related to non-disease effects of the vector. For example, some interviewees perceived that a consistent focus on nuisances associated with mosquitoes (the vector of West Nile Virus) at FINS actually fortified concerns about WNV. **Quality of life** concerns (i.e., concerns only tangentially related to risks associated with a disease) intensified perceptions of tangibility in three study sites (Tables 2 and 3).

Quality of life concerns were cited as contributing to risk perceptions most often at FINS. A majority of the interviewees there stated that community members

and visitors viewed mosquitoes and, to a lesser extent, ticks as nuisances that restricted the activities in which they could engage. More than one interviewee stated that WNV was a concern on Fire Island, but then, when asked to explain why people were concerned, the respondents described how the swarms of mosquitoes and bites from the insects can be such a nuisance. Some interviewees said nothing about *disease* after mentioning WNV; they only spoke about mosquitoes.

Other NPS and community member interviewees shared their assumption that some people purposely focused on diseases when voicing concerns about a vector, because disease concerns might urge the NPS to control the vector. These individuals were aware that quality of life concerns would not lead to such management. A FINS administrator offered his perspective;

> A lot of the communities will use, of course, the Lyme Disease or West Nile Virus as 'you've got to protect us from these', when they really only care about reducing the number of ticks and mosquitoes for comfort and convenience. We need to be careful when responding to community members – what is their motive?

A similar theme emerged at GGNRA, where an Alcatraz Island employee told me, "People use the 'safety' word to get rid of things they don't want – this is a learned response; 'safety' concerns bring in funding to study the issue." Alcatraz employees and visitors saw the guano from the seabirds on Alcatraz as a hindrance to their experience on The Rock. Many interviewees, across cases, mentioned that ostensible disease vectors "drove people crazy," indicating more than a minor nuisance. While some interviewees suggested that individuals may voice concerns about a disease to try to achieve an ulterior motive of limiting the presence of a nuisance vector, others stated that most of the public are up front about their concerns;

if they want the mosquitoes gone because the insects are noisome pests, they will say as much.

Some interviewees reported that individuals actually might have conflated all effects of a vector in their minds. Quality of life concerns, which individuals may mingle with risks originating directly from a disease, emanate in part from the expectations one has for interacting with the vector. The "part of life" and "voluntary" factors could apply to quality of life concerns just as they could to concerns directly related to the disease itself. Quality of life concerns affected tangibility in the cases of Lyme disease and West Nile Virus at FINS and the guano case at GGNRA. In all three instances, the vector of the disease (or supposed disease) was highly visible and immediately present. Concerns associated with a disease vector (but not directly associated with the effects of a disease) appeared to augment perceptions of noticeability and relevance of a disease.

All types of concerns (quality of life concerns and those related directly to the effects of a disease) have the potential to be highlighted in mass media sources. **Media coverage** (e.g., television, radio, newspaper, the Internet, film, etc.) affected the noticeability and relevance of risks across cases. For example, newspaper, Internet, and film media near GGNRA assigned blame for Lyme disease to the medical establishment (thus focusing public attention on risks related to treatment), while interviewees at FINS divulged that some Internet and newspaper sources serving Fire Island blamed the NPS for Lyme disease risks (focusing attention on risks due to transmission).

Media coverage of disease risks can help individuals understand an issue better, alert people to risks they were unaware of, or it can misinform people about disease risks. Media sources can also neglect to cover emergent wildlife or vector-borne diseases. Therefore, media coverage (or lack thereof) can either cultivate or

discourage perception of a disease and associated risks as tangible. Risk perception theory and empirical research on wildlife disease risks has repeatedly suggested that media coverage can play a role in shaping risk perceptions and reactions (Dudo et al., 2007; Kasperson et al., 2003; Roche & Muskavitch, 2003).

A Sea Grant official stationed near SBDNL reflected on how media coverage can actuate perceptions of tangibility; "A photographer from the 'Record-Eagle' took several photos [of the bird carcasses lining the beaches] that aired for two to three days in the paper. That got people talking." Media coverage, thus, vicariously exposed local residents to the risk by making its effects noticeable. While the vast majority of the interviewees at SDBNL seemed to appreciate the information the local newspapers provided, some interviewees from GGNRA were less impressed with local reporting. A law enforcement ranger explained,

> Hanta virus was huge in the media for a while. I don't know that it was ever a problem here, but because the media was really highlighting it and saying how you could contract it, we were getting a lot more concerns and questions; it was on the visitors' minds a whole lot more.

Here we see media coverage magnifying the tangibility of a certain risk, which, as another GGNRA interviewee explained, drew attention away from disease risks that were more relevant to the newsaper's audience.

Media coverage is also an important means for alerting people of actions they can take to limit exposure to a disease. **Ability to take action** to prevent exposure to or contraction of a disease (i.e., knowledge of actions and the capacity to take these actions) made some risks associated with diseases less relevant, according to interviewees at GGNRA. On the other hand, individuals at FINS who had no understanding of how to mitigate exposure to Lyme disease found the risks associated with Lyme disease to be quite relevant, according to NPS officials and local residents.

A person's belief that he or she can undertake some adaptive response to allay a risk is termed self-efficacy; response efficacy is a person's belief that the adaptive response will actually allay the risk (Bandura, 1995). At SBDNL and GGNRA, NPS communication and local media sources helped local community members gain awareness of self- and response-efficacy actions associated with botulism and Lyme disease. The importance of efficacy information in this study is consistent with previous research on risk perceptions that identified "controllability" as a factor affecting magnitude of perceived risk (Slovic, 1992).

Interviewees at FINS and GGNRA focused substantially on ability to take action as a factor affecting risk perceptions (Tables 2 and 3). Employees at these NPS units were aware of actions to limit the effects of Lyme disease. For example, a safety team member at GGNRA commented, "I think the culture here is changing as people are more prepared for [Lyme disease]. They wear long clothes, tape up their pant legs, wear DEET to keep the ticks off, and read the information." A Marin County resident and public health official acknowledged, "If you hike, you know if you are wearing pants that you put the socks over the cuffs; if you are wearing shorts, you check your legs."

Certain renters and seasonal residents at FINS, however, knew little about Lyme disease or the actions they could take to prevent exposure to this disease. According to a resident who worked in a doctor's office on Fire Island,

> I've seen people with bulls-eye rashes from tick bites come in, and the problem is most of these people, you could tell, were definitely uneducated, did not know to stay out of the weeds. They're just out of their minds; you can't do that on Fire Island.

An employee of a concessionaire at the Seashore explained how a lack of knowledge could increase perceptions of relevance, "In 2005, I had a huge number of tick bites. I

was highly concerned about [Lyme disease] when I first found all the ticks on me, because I knew little about Lyme disease; I didn't know what to think."

The preceding quotes express that exposure to new **knowledge** can make individuals increasingly aware of their ability to take action against a disease. A Sea Grant official near SBDNL stated, "[The public] want to do something, they want to help in any way that they can, they want to be involved in understanding the problem and being part of the solution." The president of an environmental NGO near SBDNL indicated that local residents who loved nature and commonly walked the beach felt less concerned about the disease risks when they could help solve the problem:

> From talking with [the volunteers], I think that their helping out with the monitoring [for dead birds] satisfies their urge to be concerned and to take an active role. They were frustrated when we had the big die off and they didn't know what to do.

The local residents' frustration reveals that their initial inability to take action to mitigate the effects of the disease may have heightened tangibility for some people. The quote also demonstrates that certain actions one takes to mitigate the effects of a disease may make risks associated with a disease more noticeable (through expanded visibility), but less relevant (through knowledge that the problem is closer to solution).

Slovic (1987) pointed to the role of knowledge in informing risk perceptions when he identified (a) the degree to which scientific experts understand a risk and (b) an individual's personal knowledge about a risk as important factors affecting risk perceptions. Psychological theories of risk suggest that the less knowledge one has about a risk (assuming that the individual is at least aware of the risk), the greater the magnitude of concern will be.

Efficacy information is only one form of knowledge that affected perceptions of tangibility, and media coverage is only one source. Knowledge about (a) the risks associated with a disease, (b) the disease itself, and (c) the disease vectors also came from communication from management entities (e.g., the NPS, NGOs, and other governmental agencies) and from personal conversations. Another form of knowledge was prior knowledge of a risk or similar risks. Prior knowledge, along with one's proclivity to seek out information affected *expectations* by predisposing individuals to a certain type or level of knowledge. For example, a law enforcement ranger at GGNRA explained how prior knowledge prepared several NPS employees to encounter and deal with ticks:

> All of the parks that I have worked in, including here, have always had an issue and concern with ticks, always. A lot of the rangers that work here, have come from other parks, and that same message is given to them from the safety officer, from the district ranger, from the chief ranger, from the natural resources staff, 'be careful when you are out in the field, but when you come back, check yourself for ticks.'

Knowledge acquired after the advent of a disease affected *tangibility* by reinforcing or undermining perceptions of relevance, depending on the nature of the newly acquired knowledge. For example, a member of the interpretation staff at SBDNL commented, "People tell me they feel more comfortable after they are provided with information that says human health is not a real concern [associated with botulism]. They have one less worry." Other data from SBDNL reveals, however, that even though the tangibility of a certain risk (e.g., human health) wanes, this does not preclude the possibility that a different risk may increase in tangibility. As some local residents in northern Michigan dismissed one risk associated with botulism, they fundamentally shifted their focus from one *type* of risk to another.

Interviewees reported that several local residents initially perceived human health risks as the primary threats associated with the botulism outbreak. After these residents learned more about the disease, large numbers of residents shifted their concerns about botulism away from human health and toward the health of specific wildlife species and the ecosystem in general. A biologist at the National Lakeshore described this phenomenon,

> Once people learn more about the greater issues involved, their concerns start changing. People start using their minds and reacting in different ways – they think about writing letters to Congressmen and wondering what else they can do to remedy the situation. They no longer only want me to heal the sick bird; they are concerned about the larger issues.

A SBDNL administrator confirmed this observation, "The more people become aware and knowledgeable, the more their concerns broaden into that larger picture, from 'what effect will this have on my recreation', to 'what effect does this have on the larger resource that we all share?'"

Data from the interviewees indicated that, up to a point, increased knowledge of a disease and its associated risks could make a risk increasingly noticeable or relevant (i.e., tangible), generally heightening risk perceptions or leading to new types of risk perceptions concomitantly. As individuals learned more about a disease, they understood better the risks associated with the disease that are most relevant to them. For example, a park administrator at SBDNL reflected, "The group that understands the whole issue is, of course, concerned about how it affects their fun time, but they take their concerns further; they become worried about additional effects of botulism."

For some diseases, however, the data revealed that as knowledge about the disease progressively continued to increase, magnitude of risk perceptions started

decreasing (compared to people who had less knowledge of the disease). A husband and wife living near WSEPP described this possibility:

> Waterfowl hunters here understand the avian influenza issue well; they realize that migration pathways could bring avian influenza here and they know well the specific migration pathways of several species. We know where stop offs are, which birds come from where, and where they go and when. … We're not concerned about avian flu more than keeping it in the back of our minds. The Fish and Wildlife Service has conducted substantial monitoring.

This quote reveals that knowledge can aid an individual in determining whether a tangible risk exists. If the knowledge indicates that the risk has little tangibility, the magnitude of risk perceptions will likely be low. Another example came from a naturalist working for a community organization in Marin County,

> I don't hear about West Nile Virus. I mean, I hear about it, but the people that I take hiking are well informed enough to realize that they are a lot more likely to die in their car on the way to the hike than they are from virtually any of these nature risks.

The foregoing quotes suggest that magnitude of risk perceptions and knowledge about a disease first exhibit a direct relationship, one increasing as the other does. At some level of knowledge, the relationship becomes inverse, with risk perceptions declining as knowledge increases. This relationship between risk perceptions and knowledge is analogous to the relationship between risk perceptions and time as explained in the issue-attention cycle hypothesis (Downs, 1972). The former relationship, however, emerged from interviewees who discussed an increase in an individual's level of knowledge over time, but also from interviewees who compared individuals with different levels of knowledge at a static point in time.

Previous research suggests a linear (as opposed to curvilinear or bimodal)

relationship between knowledge and risk perceptions (Slovic, 1987). In psychological theories of risk, increased knowledge fosters decreased risk perceptions, all else held equal. Data from my interviews suggests that the inverse relationship may exist up to a certain threshold of knowledge. For example, a natural resource manager at GGNRA expressed, "Some people are not yet concerned out here because they know so little [about Lyme disease]; it is not yet a big concern."

At SBDNL, some individuals who were highly concerned about botulism actually had more knowledge about the disease than other people who perceived a lower magnitude of risk. A professor at a local college, who studied botulism in the benthic regions of Lake Michigan with a Remotely Operated Vehicle (ROV), stated that his technician who cleaned the ROV was extremely concerned about contracting botulism and took excessive precautions when cleaning the ROV. This technician was more aware of the potential effects of botulism than some local residents were, but he was unaware that humans could not contract the disease.

Several other NPS and community member interviewees at SBDNL cited situations in which they interacted with people who had a good understanding of the high toxicity of Type E botulism, but who thought that the disease could affect humans. The interviewees explained that informed people perceived the risks associated with botulism as more tangible than other members of the public who merely knew that a disease called botulism was killing birds at the SBDNL. From these examples, it is clear that, all else equal, more information does not *necessarily* predict lower magnitudes of perceived risk, less drastic reactions to the risks, or less tangible risks.

Knowledge about disease risks can come from risk communication, but individuals also build knowledge about risks from their **direct personal experience** with the disease. Direct personal experience that arises out of historical interactions

with the same or similar risks can frame *expectations*, as discussed in the previous section. Interactions that one has had with a specific emergent disease/risk can advance perceptions of *tangibility* by making a disease and its associated risks more noticeable. Direct personal experience is closely related to, and at times intertwined, with factors such as "activities" and "visibility". Research on environmental risks has recognized the importance of direct personal experience in affecting risk perceptions (Leiserowitz, 2006; Slovic et al., 2000).

Data from the interviews suggest that people who experience a disease/risk directly often have a heightened awareness of potential risk (i.e., perceptions of tangibility), which may lead to amplified risk perceptions and novel risk reactions, compared to other community members with different experiences. An NPS administrator at SBDNL explained,

> People that write the letter or make the phone call [to the NPS to voice concern about the dead birds] are people that experienced the problem directly. People that ask me a question at a meeting may have experienced the effects or they read a newspaper article: 'Oh, here's someone from the park, and I read an article on it, so I will ask him a question.' I see a different level of effort with direct experience.

This quote indicates that direct experience increased the amount of attention some people gave to the risks associated with a disease. The park administrator cites increases in information seeking for people who saw the dead birds personally.

Direct experience with a *similar risk from the past*, however, seemed to condition some individuals to think less cognitively about the risks. A visitor use assistant at SBDNL explained how local residents developed heuristics about what to expect from a current disease based on the effects of previous diseases:

> Historically, the area has heard about massive alewife kills. This happened a number of years in succession [in the 1960s]. Some of the locals remember what the beaches looked and smelled like. They had beach problems before, and the dead birds showing up recently is just another twist on this older problem.

The editorial board of a local newspaper confirmed the potential salience of this heuristic when a member quipped, "Most people here remember the sixties; it was hard to tell what was dying on those beaches in the sixties." Heuristics that shape expectations for future events based on prior experience seemed to abate perceptions of tangibility for some long-time residents near SBDNL.

Direct personal experience with a disease or vector, or lack thereof, swayed individuals' perceptions of the frequency with which disease risks could affect them or things about which they cared. Whether people perceive a risk as constantly present, sporadically present, or a single isolated event, influenced the degree to which disease risks were noticeable and relevant to NPS employees and the public. **Continuity of concern** was a factor cited predominately at GGNRA (Tables 2 and 3).

Some diseases I studied came in cycles, due to the ecology of the disease and/or vector. The temporal nature of disease risks contributed to cyclic differences in the degree to which the risks were perceived as tangible. Public opinion polling of representative national samples of adults in the USA has revealed that whether the public perceive a disease as a constant or episodically occurring threat can affect risk perceptions (Ho et al., 2007). The study found that attention to disease is event driven; if events exemplifying the disease's risks do not continuously occur, consideration of the disease wanes precipitously.

At SBDNL, the fact that botulism struck hardest in the late autumn one year may have reduced tangibility (and, thus, the magnitude of risk perceptions and

reactions) in some segments of society due to reduced visibility of the effects of the disease. A National Lakeshore visitor-use assistant recalled, "I saw some people on the beaches while monitoring for [dead] birds, but the rain, wind, and cold kept most people off the beaches in October and November [of 2008], when the largest die-offs occurred. The weather and season made people less aware of the issue." A town official from a Fire Island municipality explained how continuity of concern advanced differing degrees of tangibility in two types of Fire Island residents; "The year-round residents experience the full range of the tick season; they perceive it differently [than seasonal residents] because they see all the stages, the full cycle [of all the life stages of the tick]."

The diseases that emerged in cyclic fashion drew attention and risk perceptions that waxed and waned with the seasons; interviewees commented that one could predict that concerns would spike at a certain time of year. Other diseases appeared suddenly and then vanished. A public health officer near GGNRA commented on the rare case of plague that occurs in the Bay Area; "[Newspaper] articles on plague occur on a per event basis; reporting is limited to novel events and then attention and concern subside."

The foregoing discussion reveals that the ten factors that emerged as influences on tangibility are not entirely separate from factors affecting expectations; indeed, some factors such as activities, knowledge, management actions, and trust linked expectations and tangibility almost seamlessly. I continue to explore the connections between expectations and tangibility in the next chapter.

Synthesis

The themes and factors identified in this chapter emerged from the 106 interviews. Because I selected and named these factors on the basis of interview data, few of the factors have been identified by the exact terms I employ here in the

theoretical or empirical research on risk perceptions and reactions. The majority of the factors that emerged are not surprising, however. Leading risk researchers (e.g., the creators of the SARF) have cited some of the factors as important influences on risk perception development for decades. Other factors make sense when viewed through the lens of cultural, social, and/or psychological theories of risk. Some of the factors that emerged, however, seem novel to research on risk perceptions. The "quality of life", "part of life", and "ubiquitous" factors stand out as constructs affecting risk perceptions in this research that are absent in previous work.

The two organizing themes, *expectations* and *tangibility*, additionally present a new means for organizing the various factors affecting risk perceptions and reactions. The interview data revealed that several factors shaped expectations. Cultural norms, understandings, and an individual's experiences before he or she is aware of a disease and its associated risks contributed to expectations in each case. These factors predisposed populations (on the aggregate) to certain expectations prior to the disease's emergence; when it emerged, the people's latent expectations helped them either (a) accept and deal with risks or (b) led them to be shocked, annoyed, or worried by those risks.

Interviewees indicated that expectations also developed over an individual's history of experience (direct or vicarious) with a disease in some cases. Once a disease emerged and gained tenure in an individual's mind (or a population's collective consciousness), he or she (they) sometimes came to perceive and react to the disease, its vectors, and its associated risks differently and recalibrated expectations accordingly.

While I have encountered nothing in the theoretical literature specifically about the ways in which expectations can affect risk perceptions and reactions, some empirical research supports the finding that interactions with wildlife not conforming

to expectations can elevate concern associated with those interactions (Leong, 2010). Expectations of deer abundance and behavior emerged as a central theme predicting attitudes and opinions about deer in Leong's (2010) study that queried populations living in and around three NPS units.

The factors discussed in this chapter demonstrate that expectations played an indirect role in dictating the extent to which individuals perceived a risk as tangible; tangibility and expectations then jointly conditioned risk perceptions and reactions. For example, an expectation that one will not experience disease in a natural setting might lead him or her not to take precautions to prevent exposure; the expectation acts as a filter for what is relevant. One might then interact with a disease or disease vector in a way different from someone with the expectation that diseases are regular components of natural landscapes. Expectations, thus, could influence one's exposure to a disease and its associated risks. This exposure would influence, in turn, one's perceptions of tangibility. The types and magnitude of resulting risk perceptions and reactions would arise from the interaction between tangibility and expectations.

In the next chapter, I discuss further a possible emergent framework based on these two themes and their component factors, which could serve as a useful mechanism for understanding how people perceive and react to risks. I also consider potential reasons for the varying attention paid to certain factors across cases (Tables 2 and 3).

Chapter Six: Implications for Theory Development

"A single light casts away a thousand shadows"

-- St. Augustine of Hippo (354-430)

Leading risk perception theorists generally agree that a panoply of diverse factors influence individuals' risk perceptions (Pidgeon et al., 2003; Krimsky & Golding, 1992). The advent of the Social Amplification of Risk Framework (SARF) in 1988 altered discourse about risk perceptions by suggesting that cultural, social, and psychological factors work in concert to affect risk perceptions (Kasperson et al., 1988).

I studied the ways in which individuals perceived and responded to risks associated with wildlife and vector-borne diseases in an effort to increase understanding of *how* people perceive and react to these risks (i.e., the processes and factors affecting perceptions and reactions). In line with current thinking in the field of risk analysis, my findings suggest that multiple factors, most of which are similar to established tenets of the principal theoretical traditions, amplified and/or attenuated risk perceptions and reactions in the four cases in which I collected data.

Factors that emerged from my data, such as values, local cultural context, and aspects of trust and community capacity, underscored the significance of cultural factors in inaugurating risk perceptions. The role of societal response to a risk in shaping risk perceptions and reactions was evinced through factors such as management actions, media coverage, and facets of ability to take action and knowledge. Personal response to a risk clearly affected risk perceptions and reactions through multiple factors: activities, part of life, quality of life, and direct personal experience. Finally, factors also suggested the import of perceptions of risk

characteristics (i.e., characteristics of the disease and disease vectors): probability, visibility, proximity, and continuity of concern. The data from my interviews, therefore, reveal that, as the SARF predicts, cultural, social, *and* psychological factors affect the ways in which people perceive and react to risks (regarding wildlife and vector-borne diseases).

The Relative Import of Various Factors

Equally noticeable to the observation that multiple factors affected risk perceptions and reactions are the realizations that (a) the presence of some factors is likely more context specific than the occurrence of others and (b) certain factors assumably affect risk perceptions and reactions to a greater degree than other factors do. Evidence for the first recognition comes from Tables 2 and 3; several interviewees from each case talked profusely about the effects of factors such as values, activities, trust, community capacity, visibility, management actions, ability to take action, and knowledge. These factors demonstrably transcend contexts; one might expect them to affect risk perceptions and reactions regardless of cultural, social, environmental/geographic, and epidemiological variations across cases.

The near absence of some factors from certain cases is also striking. Three factors sparsely cited in most cases (i.e., part of life, ubiquitous, and voluntary) were important factors at Fire Island, and at Fire Island only. The extensive presence and general awareness of ticks, mosquitoes, Lyme disease, and West Nile Virus in this case made the 'part of life' and 'ubiquitous' factors highly identifiable (i.e., people either clearly accepted or strongly rejected these perceptions). Likewise, the cyclical nature of exposure to Lyme disease at GGNRA, compared to sporadic emergence of plague and hanta virus in that case allowed for increased attention to continuity of concern as a relevant factor. Both of the foregoing examples demonstrate how

epidemiological context conditioned the ways in which factors influenced risk perceptions and reactions.

A factor not being in the consciousness of a given population may occasionally render that factor irrelevant. Some factors are objective constructs; for example community capacity exists independent of whether a population is focused on it or not, and it is the objective presence or absence of this factor that affects risk perceptions and reactions, by conditioning management of the risk(s). Other factors, however, exist only in individuals' minds or in a group's collective consciousness. Risks are not voluntary; people *perceive* them as voluntary or involuntary. Therefore, an active perception of a risk as voluntary could decrease the magnitude of risk perceptions; perceptions of a risk as involuntary could increase the magnitude of risk perceptions. Failure to identify a risk as voluntary or involuntary does nothing to risk perceptions and cedes the factor as immaterial.

Just because a factor is not cited, however, does not *necessarily* mean that the effects of that factor are not applicable in a given case. For example, at Wrangell-St. Elias there was certainly no reason for anyone to connect quality of life concerns to avian influenza (i.e., concerns not related to a disease or its effects, but to some other related factor, such as a vector); thus, no one mentioned quality of life. It still holds, nonetheless, that a lack of quality of life concerns contributes to a lower magnitude of risk perception associated with avian influenza than if there were quality of life concerns in addition to concerns related directly to the disease.

The awareness that some factors are context specific necessitates that some cases will not contain all twenty factors identified here. By corollary, the relative importance of factors in conditioning risk perceptions and reactions will vary between cases. Tables 2 and 3 provide some indication of this. Examining only these figures can be misleading, however. For example, interviewees at GGNRA made over 100

references to the role of management actions in affecting risk perceptions and risk reactions. Based on my 28 interviews at GGNRA, I would not characterize a single interviewee as thinking that management actions were the most important determinant of perceptions or reactions. Indeed, multiple interviewees indicated that 'ability to take action' (with only 37 references) was the most important factor that affected how the local population perceived and reacted to disease risks.

The foregoing discussion has important implications for managing risks, particularly through communication. Because some factors are tied to objective constructs (and because the objective constructs are necessarily tied to contextual traits), managers can begin to understand risk perceptions and reactions by understanding the social, cultural, environmental/geographic, and epidemiological contexts. For example, knowledge of how long a disease has been clearly identifiable locally will give a manager a good idea of the issue-attention cycle factor. Reference to Table 4 would reveal whether that factor might make certain messages relevant. A newly emergent disease, for example, would predictably lead to elevated risk perceptions through the issue-attention cycle factor. If a manager knew, however, that the newly emergent nature of the disease is not entirely accurate because the disease existed and had been managed effectively elsewhere, communication could be used to make the disease seem old news by depicting it as a long-standing disease.

Another implication of the varying import of the twenty factors is that managers should be ready, in all cases, to evaluate the effects of those factors that seem to transcend specific contexts (e.g., the factors that were cited frequently in each case). While additional research is needed to validate the transferability of each factor, consistency across the four diverse cases provides some indication that these factors may be generalizable.

A final implication is that factors tied to constructs that objectively exist will predictably affect risk perceptions in all cases; factors that exist in the mind only will affect risk perceptions in merely some cases. For example, 'visibility' is not entirely contingent upon, but strongly based on the objective presence of signifiers of the disease in the local landscape. Therefore, irrespective of whether those signifiers are infinitely present or infinitely absent, Table 4 indicates that their presence or absence reveals some information about risk perceptions. Managers would benefit from always evaluating the presence or absence of objective constructs to which factors are tied closely.

Community-level Versus Individual-level Attributes

One way of distinguishing between the types of factors that affect risk perceptions and reactions, as done in the previous section, is to identify factor subsets based on the factors' connection to objective constructs. Another means of differentiation separates the factors based on whether they speak to community- or individual-level attributes. I have already discussed potential managerial implications of understanding the degree to which a factor is attached to an objective construct; separation of the factors into community and individual attributes also has interesting theoretical and managerial implications.

While most risk experts accept that cultural, social, and psychological factors condition risk perceptions, each researcher seems to retain his or her own conception of which category of factors exerts the most influence on risk perceptions and reactions. Understanding the relative salience of community versus individual attributes could provide an awareness of the relative importance of each category of factors; it could also help managers gauge how to target risk communication. For example, factors stemming from community attributes have much more clearly

defined audiences for potential messages and may represent an easier set of factors about which to communicate.

A few of the emergent factors *are* community-level attributes (e.g., local cultural context, community capacity, and media coverage), other factors are individual-level attributes that seemed to be strongly *based on* community attributes (e.g., values, activities, blame, trust, perceptions of management, knowledge). Most of the factors are individual perceptions based on objective constructs and community framing of the constructs, making adherence to these factors a combination of community- and individual-level attributes. This group includes issue-attention cycle, ubiquitous, probability, visibility, proximity, quality of life, ability to take action, and continuity of concern. Primarily individual characteristics and decisions account only for three emergent factors: part of life, voluntary, and direct personal experience. (While it is possible that the part of life and voluntary factors could be influenced by social norms, in this study, it seemed most instances of these factors related to individual characteristics and decisions.)

While it may be useful to differentiate between the effects of community- and individual-level attributes, the messy entanglement of risk perceptions and reactions (individual-level phenomena by definition) with context (a community-level phenomenon by definition) make such distinction a formidable task.

Comparison of Findings to the SARF

Thus far, I have discussed the twenty factors individually, as unique influences on risk perceptions and reactions. While this is a useful exercise as it allows for the differentiation of distinctive types of factors with varying managerial implications, the data clearly indicate that many of the factors are linked closely. The emergent factors support the SARF's contention that major influences on risk perceptions and reactions are interdependent; they operate through interactive relationships. Established theory

and the case studies' findings predict that the eventual effect of a host of factors on an individual's risk perceptions is not additive; multiple factors moderate or mediate the effects of other factors on the ways in which an individual perceives risk. For example, values can affect activities, which in turn can lead to direct personal experience, which sequentially transforms perceptions of probability and visibility.

Chapter five made clear that most factors affecting amplification and attenuation of risks in the four cases are covered in the SARF (although, perhaps, with different names). A few factors, however, are not explicitly mentioned in this comprehensive framework. A likely explanation for this is that the SARF focuses more on the *ultimate* (i.e., distal or foundational) aspects of societal organization and individual perceptive capacity that allow factors to emerge than on the *proximate* factors that affect risk perceptions and reactions (i.e., those factors most closely related to and immediately affecting the perceptions and reactions). Indeed, the 'part of life,' 'ubiquitous,' and 'quality of life' factors (those factors that seemed most foreign to the SARF) could likely be explained through the SARF's identification of 'individual senses,' 'evaluation and interpretation,' and 'cognition in social context' as amplification and attenuation stations (which represent distal influences).

The findings from the case studies, thus, suggest a means for improving upon (or adding to) the SARF, by describing the ways in which risks are amplified and attenuated with greater specificity. While some of the factors in the SARF contain the same level of explicitness as the factors that emerged in the case studies (e.g., the SARF's 'organizational responses' and 'news media' as compared to this study's 'management actions' and 'media coverage'), others are more vague in terms of their effects on risk perceptions and reactions (e.g., 'attention filter'). Each of the factors that emerged from the case studies is operationalizable (using the definitions in Table 2) and testable, in the sense that one could identify whether each factor is present or

not in a given population with respect to a certain risk. One could evaluate whether each factor has the anticipated effect on risk perceptions, as described in Table 4.

Beyond the effects of the individual factors on amplification and attenuation of risk perceptions and reactions, the themes of expectations and tangibility offer the basis for a potentially useful framework for explaining *how* the various factors amplify and attenuate risk.

An Alternative Framework

I present here a framework, The Framework of Expectations and Tangibility (FEAT), organized around the themes of *expectations* and *tangibility*. It combines the twenty operationalizable and testable factors that amplified and/or attenuated risk perceptions and reactions in the four case studies. On a theoretical level, this framework offers a proposition for *how* its component factors affect risk perceptions. Though not as comprehensive as the SARF, in chapter seven I explain in detail some ways in which this alternative framework may be more useful for risk managers (including risk communicators) than current frameworks that combine multiple influences on risk perceptions.

Expectations and *tangibility* emerged from the interview data as two organizing themes under which I categorized the twenty emergent factors. These themes determined the types and magnitudes of risks that individuals in the cases perceived regarding wildlife and vector-borne diseases. While chapter five provides evidence that both themes were essential to explaining risk perceptions and reactions in each of the four cases, it also reveals that roles played by the various component factors within those themes varied across cases.

The twenty factors were obviously dependent on the cultural, social, environmental/geographic, and epidemiological contexts in which they emerged. For example, while ten interviewees cited continuity of concern as an important factor at

GGNRA, less than half that amount identified this factor as affecting risk perceptions in the other cases (Table 3). Ten interviewees at FINS mentioned the ubiquitous factor, but no more than two interviewees cited this factor in any other case. Other factors (i.e., values and management actions) were cited by a majority of the interviewees in each case. Both similarities and differences abounded in the ways in which the interviewees in varied contexts characterized contributions to risk perceptions.

The FEAT is not dependent on specific factors that transform the types or magnitudes of risks one perceives; rather, the framework simply states that expectations, tangibility, and the interaction between these themes condition risk perceptions and reactions. Component factors are important in establishing the *means by which* expectations and tangibility affect risk perceptions, but because these factors demonstrably vary between contexts, the FEAT does not include any specific factor as *necessarily* contributing to either theme. The goal of the FEAT is to be widely applicable and parsimonious.

I relied on data regarding wildlife and vector-borne diseases in four varied but unique cultural, social, environmental/geographic, and epidemiological contexts to construct this framework. No theoretical distinction makes the expectations or tangibility themes apply to wildlife disease risks better than other risks; the themes simply emerged from data with a particular focus. Future research could identify whether it is appropriate to limit the FEAT to risks associated with wildlife diseases.

The purpose of my research, as discussed in chapter three, was to generate theoretical propositions that explain how individuals perceive risks. The FEAT presents a proposition for future testing. I make no certain claims about the credibility of this framework, even in reference to risk perceptions associated with wildlife and vector-borne diseases; I merely offer the FEAT as a theoretical proposition. In line

with methods of Grounded Theory, which informed my approach to data collection, the qualitative interview data allowed me to construct a proposition, but not to test it.

Recall that expectations refer to individuals' (or a population's aggregate) beliefs about characteristics of a risk and risk management that people "look for as due" from a given context (e.g., when recreating on or living near public lands). Tangibility describes the degree to which individuals perceive risks and the risk object (e.g., the disease, disease's effects, and disease vectors) as relevant and/or noticeable.

Emergent from the data presented in chapter five, the FEAT presumes that expectations interact with tangibility to cultivate risk perceptions and reactions. This interaction can be used to predict the amplification or attenuation of risk perceptions and reactions (Figure 1). A researcher or manager could gain an awareness of expectations and tangibility by investigating (a) the extent to which individuals' (or populations' aggregate) expectations are met related to a disease, disease vectors, and effects of the disease (and why) and (b) the extent to which the risk is *tangible* to those individuals (or populations), and why. Table 5 provides a heuristic for understanding how tangibility and expectations affect the general magnitude of risk perceptions. This heuristic interpretation of the FEAT is useful for quick reference and for reviewing the general relationship between magnitude of risk perceptions, expectations, and tangibility, but it is simplistic.

Table 5. Effects of tangibility and conformity to expectations on magnitude of risk perceptions

		Are **expectations** met with respect to the disease and effects of the disease?	
		Yes	*No*
Is the risk **tangible**?	*Yes*	**Medium** magnitude	**High** magnitude
	No	**Low** magnitude	**Nil** magnitude

Tangibility and conformity to expectations both occur on a continuum (e.g., a risk is tangible to some *degree*); the effects of a wildlife disease, for example, cannot accurately be characterized as simply "tangible" or "not tangible." Figure 1 illustrates this continuum. The figure shows, generally, that as individuals perceive a risk as increasingly *tangible*, expectations held constant, magnitude of risk perceptions increases (thus increased tangibility leads to an amplification of risk perceptions and subsequent risk reactions). As a risk's conformity to one's *expectations* increases, tangibility held constant, magnitude of risk perceptions decreases.

These relationships hold generally, but Figure 1 predicts some instances where the common trends would not hold true. For example, even at extremely high levels of tangibility, magnitude of risk perceptions may only be 'medium', if expectations are almost completely met. Note that there are no units on the axes in Figure 1; thus, it is meant to simply display broad-spectrum relationships. The lines separating 'nil' from 'low', 'low' from 'medium', and 'medium' from 'high', therefore, are not definitive boundaries, but simply devices to illustrate the regions where risk

perceptions of a certain magnitude exist. Some examples from the data in chapter five help ground the relationships postulated in the FEAT.

At WSEPP, many local residents *expected* little, if any, tangible risk to be associated with avian influenza; they expected not to experience avian influenza. Additionally, no residents experienced avian influenza and most residents *perceived* little tangible risk (i.e., risks were not noticeable or relevant). The interaction of expectations and tangibility inclined the residents to perceive nil magnitude of risk ("A" in figure 1). In this case, one immediately realizes that expectations and tangibility are *ultimate* as opposed to *proximate* influences on risk perceptions and reactions. Values, activities, and trust strongly affected expectations; management actions, (lack of) visibility, and knowledge clearly prompted perceptions of tangibility.

At FINS, certain populations of permanent residents and renters/seasonal residents had that same expectations of few, if any, risks associated with wildlife and/or vector-borne diseases, but then perceived Lyme disease as highly tangible. The same was true of local residents and NPS employees at SBDNL when botulism first emerged. The FINS and SBDNL individuals exhibited high magnitude risk perceptions ("G" and "F" in figure 1).

At SBDNL in 2007, the year following the initial botulism outbreak, conformance to expectations increased markedly. Local residents and NPS employees expected moderate to highly tangible risks and experienced just that. This interaction between expectations and tangibility disposed the residents and employees to a lower magnitude of risk perceptions than in the aforementioned case where expectations were not met ("E" in figure 1). A shift in expectations from exposure to few, if any, risks to expectations of moderate potential for risks to affect things about which local residents care (with perceptions of tangibility relatively unchanged) thus attenuated risk perceptions.

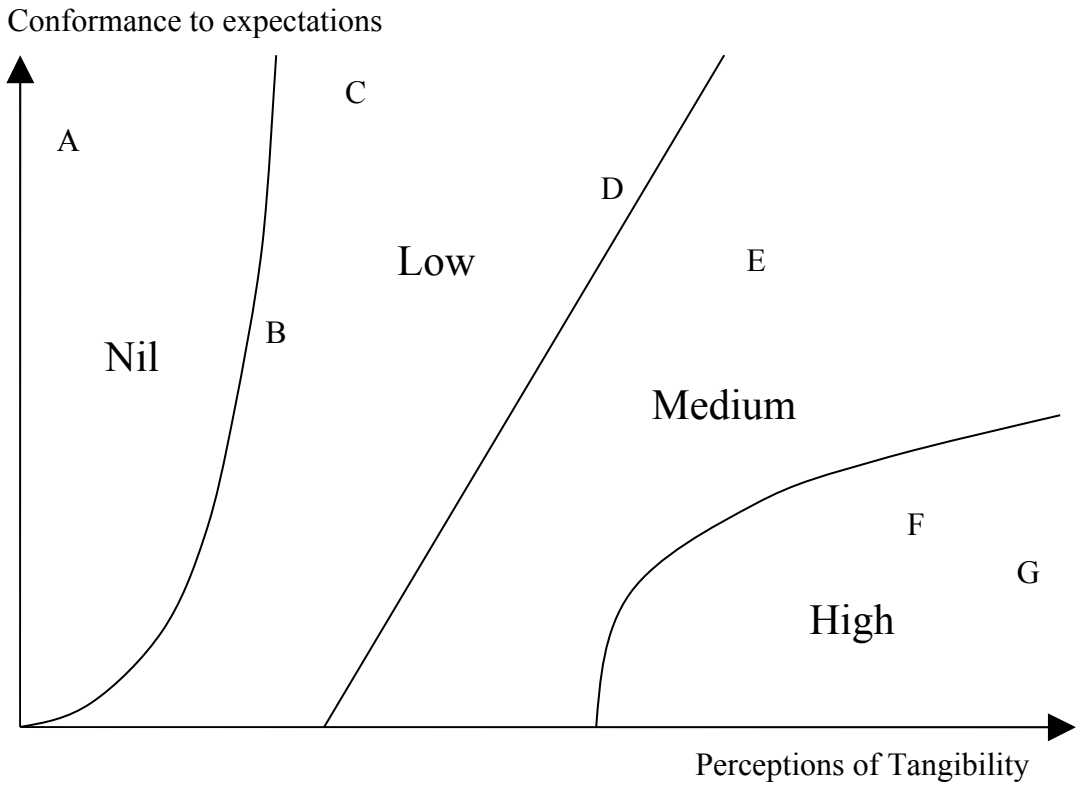


Figure 1. The Framework of Expectations and Tangibility

*Note: Nil, Low, Medium, and High refer to the magnitude of risk perceived by an individual exposed to a risk with the noted levels of perceived tangibility and conformance to expectations. The letters indicate approximate placement within this framework for populations from the four cases.

A – WSEPP (local residents)
B – GGNRA (local residents)
C – GGNRA (NPS employees)
D – FINS (NPS employees and local residents who identified Lyme disease as a voluntary part of life)
E – SBDNL (local residents and NPS employees, a year after botulism first emerged)
F – SBDNL (local residents and NPS employees, when botulism first emerged)
G – FINS ((a) local residents who perceived the risks associated with Lyme disease as involuntary and whose expectations for NPS management went unfulfilled and (b) seasonal residents and renters who were unaware of the presence or effects of Lyme disease until being directly exposed)

One major potential interaction between conformance to expectations and perceptions of tangibility that did not emerge in any of the case studies was the situation where a risk does not conform to expectations and is perceived as minimally tangible (e.g., one expects a highly noticeable and relevant risk and then does not perceive this). While no such risk was noted in the interviews, the H1N1 influenza ("swine flu") outbreak in the USA in 2009 is an example that likely fit this description for many US citizens. In such an instance, the FEAT would predict that an individual would have greater magnitude of risk perceptions than if a risk of the same degree of tangibility met one's expectations (figure 1). The FEAT makes this prediction based on the data's emergent pattern that less congruence with expectations generally afforded a greater magnitude of perceived risk.

The foregoing examples illustrate some ways in which expectations and tangibility can interact; tangibility mediates the effects of expectations on magnitude of risk perceptions. Remember, however, that tangibility and expectations can also affect each other directly. The data presented in chapter five reveal that expectations were based primarily on factors antecedent to the emergence of a risk (i.e., values, activities, local cultural context, trust, and community capacity) and on factors that emerged from changing perspectives over a history of interaction with the risk (i.e., issue-attention cycle, part of life, ubiquitous, voluntary, and blame). Thus, tangibility, which proceeds directly from interaction with and response to a risk, is affected by and can affect expectations. An extended example, which more than one interviewee at FINS used to describe his or her personal experience, illustrates the possible relationships between expectations and tangibility:

The interviewees originally were urbanities from New York City who, when they first visited the Seashore had little exposure to Lyme disease or ticks and did not expect to be exposed to any diseases when going to the beach or hiking

trails. A joy of recreating outdoors (and specifically at the beach) then placed these individuals in a situation where a disease vector (e.g., ticks) was highly visible and where there was a substantial probability of contracting a disease (e.g., Lyme disease). A high magnitude of perceived risk resulted, with risks being very tangible. After direct personal experience with the disease vector, the individuals acquired more knowledge about ability to take actions to limit exposure to the risk through agency risk communication, media coverage, and informal social interactions.

The new knowledge helped the persons realize that Lyme disease risks are ubiquitous, thus prompting them to alter their expectations for exposure to the risk. The altered perceptions of spatial and temporal presence of the disease and the individual's latest understanding of how to prevent exposure to the disease facilitated a view of the risk as a voluntary part of life. These perceptions fostered a decrease in the magnitude of the individuals' risk perceptions due to a change in expectations, even as the risk remained highly tangible.

The example of these two interviewees suggests that the interaction between conformance to expectations and perceptions of tangibility can affect the *magnitude* of risk perceptions and predict amplification or attenuation of risk perceptions. The FEAT is constructed to forecast magnitude, but the information needed to make that calculation also provides an awareness of the *types* of risks that an individual perceives. To predict magnitude of risk perceptions with the FEAT, one must know (a) the degree to which expectations about a disease and its effects are met and (b) the degree to which an individual perceives a risk as tangible. To determine whether an individual's perceptions of tangibility conform to his expectations, one would need to know the specific types of risks that he expects.

Comparing the FEAT with the SARF

The SARF clearly states that its various factors (or "amplification stations") work in concert to predict risk perceptions and reactions; however, the mechanism or process by which the factors jointly amplify and attenuate risks is not nearly as transparent. While the SARF offers "feedback and iteration" as an explanation for how its factors unitedly amplify and attenuate risk perceptions and reactions (Kasperson et al., 2003), the framework seems to afford much more justification for how each factor individually operates. If we believe the commonly cited theoretical premise that factors do not simply have additive effects on risk perceptions and reactions, we would do well to refrain from discussing almost exclusively the roles of individual factors; we must identify a process or set of processes by which the factors function together. I present the FEAT as a possible means for clarifying how factors can work jointly to amplify and attenuate risk.

Future Research

The FEAT is a *proposition* for a framework that brings increased clarity to the question of *how* various factors work in concert to explain amplification and attenuation of risk perceptions and risk reactions. The data in chapter five and the discussion in this chapter suggest that *expectations* and *tangibility*, and the interaction between those themes, can explain the ways in which certain populations perceived risks regarding wildlife and vector-borne diseases in and near four NPS units.

Several future research directions may prove fruitful in exploring the credibility of or refining the FEAT. First, additional exploratory case study research could examine whether expectations and tangibility emerge as governing themes in different contexts and with respect to novel risks. This research would allow one to conjecture about the transferability of the FEAT. A second line of inquiry could examine fresh risks in unique contexts in an attempt to identify the extent to which the

emergent *factors* identified in chapter five are transferable (and whether some important factors were not captured in the four cases in this study). Even though expectations and tangibility are offered as the guiding themes for the framework, there may be important factors that should be included as component parts of those themes (e.g., values for expectations and management actions for transferability).

Third, one could operationalize and test the extent to which expectations and tangibility are able (a) to reveal the types of risks that people perceive and (b) to predict the magnitude of their risk perceptions. Basic operationalizations of tangibility that I have offered here are (a) the degree to which a risk is noticeable and (b) the degree to which a risk is relevant (i.e., affects an individual or something about which that individual cares). I have operationalized expectations as beliefs about risks (and management actions) individuals look for as due in a given context. Testing the predictive ability of expectations and tangibility could speak to the credibility of the FEAT.

Conclusion

Comprehensive frameworks have combined major factors affecting risk perceptions and reactions for over three decades. Risk experts today generally accept that multiple factors from each of the leading theoretical traditions (i.e., cultural/social theories of risk and psychological theories of risk) are needed to accurately explain risk perceptions and reactions. The SARF, widely considered the most complete comprehensive framework, does an excellent job of identifying a host of ultimate factors that amplify and attenuate perceptions of and reactions to risks. The SARF, however, does not (a) clearly identify the proximate factors that stem from some of its ultimate factors or (b) explain *how* (i.e., the process by which) its factors conjointly affect perceptions and reactions.

The foregoing discussions reveal some ways in which the case study research reported herein can supplement the firm foundation that the SARF (and the theories from which the SARF proceeds) has laid. First, data analysis exposed at least three emergent factors affecting amplification and attenuation of risk perceptions and reactions that have not been, to my knowledge, heretofore cited in risk research (i.e., 'part of life,' 'ubiquitous,' and 'quality of life').

Second, I offer the FEAT as a means for understanding one possible process by which factors work in tandem to amplify and attenuate risk perceptions and reactions. The FEAT also could serve a practical purpose by providing managers with a clear, parsimonious, and useful way of characterizing and evaluating risk perceptions related to a management concern. This knowledge can help inform the selection of management actions, including the creation of risk communications. These practical implications of the FEAT are the focus of chapter seven.

Chapter Seven: Implications and Recommendations for Risk Management

"Do not commit your poems to pages alone. Sing them, I pray you."

-- Virgil (70-19 B.C.E.), *Aeneid*

In this chapter, I discuss how the findings from the case studies and the Framework of Expectations and Tangibility (FEAT) could help risk management entities assess and respond to public risk perceptions. Understanding the public's perceptions about and reactions to a management concern could benefit risk management entities by (a) emphasizing the types of risks to focus on in communication, (b) identifying audiences who could derive advantage from risk communication, (c) alerting the entity to risks of which the entity was previously unaware, and (d) identifying the public's expectations for risk management. The following discussion is tailored to agencies that manage natural resources, and particularly to wildlife disease management within the NPS, because my recommendations likely would be most relevant to the contexts in which I conducted my research. At the chapter's end, I discuss potential for applying lessons to contexts beyond wildlife disease management.

Goals of Risk Management, Including Risk Communication

The findings reported herein could prove useful to managers if they met the goal(s) that risk management entities seek to achieve through management (including communication). The mission of the NPS is to

> …promote and regulate the use of the...national parks...which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as

will leave them unimpaired for the enjoyment of future generations (National Park Service Organic Act, 16 U.S.C.1.).

Therefore, it follows that a goal of risk management in the NPS, with respect to wildlife disease, could be to adhere to this mission by protecting concomitantly (a) the natural and cultural resources in the NPS units, (b) the safety and well-being of the public who use the units, and (c) the quality of the public's experience in the units.

The best manner by which to achieve this ambitious goal is not clear. I suggest a combination of methods: (a) ensuring that the public is able to make informed decisions about whether risks pose a threat to them or to things about which they care (through risk communication) and (b) considering updating management actions to address risks that may not have been accounted for in technical risk assessments. One must caution against using risk communication in an attempt to change well-informed risk perceptions that differ from technical risk assessments. A management agency can have legitimate concerns (e.g., protecting certain natural or cultural resources) that members of the public find irrelevant to anything they care about, and not all legitimate public risk perceptions will relate to things an agency identifies as immediately relevant (e.g., aesthetic considerations).

For wildlife diseases, like many other health risks, increasing public awareness of risks may seem, at first, to be an admirable goal that will help protect people from harm. Increasing awareness (even if it leads to behavioral changes), however, is by no means the only potentially beneficial communication goal. For example, if efforts to increase awareness of a disease amplify risk perceptions beyond what is necessary to protect public health, the elevated concern could produce negative collateral effects. People might begin to view important natural components of the ecosystem as pests, which could reduce support for the NPS's policy of maintaining its units in a natural state (Decker et al., 2010). This could also problematize the NPS's objective of

contributing to public appreciation and enjoyment of nature. Because individuals differ in their valuation of experiences and in their penchant for risk aversion, preparing the public to make informed decisions would allow each individual to decide the degree to which limiting interaction with the environment outweighs its costs and the degree to which one may be able to limit risk in other ways (e.g., personal protection).

Toward Achieving Risk Management Goals

Individual factors.

To allow individuals to make informed decisions, risk communicators would profit from first understanding the degree to which those individuals perceive a risk (e.g., a disease, a disease's effects, or a disease vector) as relevant and why they find that risk relevant. Thus, it would be to managers' advantage to understand the factors that condition their risk perceptions and reactions.

The factors identified in the findings section as affecting risk perceptions and reactions can be separated into three categories (discussed briefly in chapter six), each with distinct implications for risk communication. First are factors that were themselves objective constructs (e.g., values, activities, local cultural context, community capacity, visibility). Even if they were not in the public consciousness, these factors predictably affected the populations' aggregate risk perceptions in certain ways (Table 4). Risk communicators could establish a baseline understanding of most of these factors even before a risk emerges and then use this understanding to judge potential for amplification and attenuation when a risk does emerge.

Second, most factors were in essence perceptions, but were based substantially on objective constructs (e.g., issue-attention cycle, ubiquitous, blame, trust, probability, proximity, management actions, quality of life, media coverage, ability to take action, continuity of concern). All of these factors are related to the specific

disease risk. The objective constructs on which the perceptions are based can be assessed shortly after a disease with potential risks comes to a manager's attention. For example, while an individual's *perception* of a disease's placement within the issue-attention cycle is what really matters, and not the objective location of the disease with the cycle, it is unlikely (but not impossible) that one will perceive a disease as having existed in his community for a long time if it is newly emergent. Therefore, when pressed to make quick decision about risk communication, the objective constructs could temporarily stand in for this category of factors, allowing managers rapidly to assess potential for amplification or attenuation or certain types of risks (Table 4).

The third and final group of factors is also composed of perceptions of objective constructs (e.g., part of life, voluntary, knowledge, and direct personal experience). This category differs from the second group in that either the factors in this group (a) were connected more loosely to the objective constructs or (b) individuals in the same population relied on different objective constructs to form their perceptions. For example, while direct personal experience is obviously an objective construct, the construct is different for each person. Likewise, while the part of life and voluntary factors are connected loosely to some construct (e.g., spatial and/or temporal presence of a disease), extremely different perceptions by long-time next-door neighbors who engaged in similar activities, indicated only a loose connection to any construct. Because of high variation in perceptions, this category of factors requires the greatest amount of work on the part of the manager. Before being able to assess risk perceptions based on these factors, the manager will need to gather some data on these factors, potentially through interviews with key informants, a public poll, a formal systematic survey of appropriate stakeholders, etc.

Expectations and tangibility.

Beyond understanding the role of individual factors, identifying conformance to expectations and perceptions of tangibility could assist managers in understanding the process by which the various factors holistically amplify or attenuate risk perceptions and reactions. Revealing expectations and tangibility for the public could help inform a manager about the types of concerns that an individual or community has, and, therefore, why the risk is relevant. An extended example illustrates this point:

At SBDNL, local residents' expectations for what they would experience on the beaches when botulism first emerged did not include interaction with large quantities of bird carcasses. The residents expected no risk, but found multiple risks (e.g., threats to human health, bird health, ecosystem health, aesthetic beauty; Figure 1, letter "F"). From an understanding of these types of perceived risks, risk managers identified which risks they needed to communicate about to correct misinformation. The managers also identified potential physical management actions that could alter risk perceptions (e.g., removing birds carcasses to improve aesthetic beauty), and then assessed the pros and cons of such actions.

If conformance to expectations and/or perceptions of tangibility differed from those in the SBDNL example, the content of an effective management response could vary markedly. The data presented in chapter five indicate that local residents at GGNRA generally had expectations of few risks associated with Lyme disease and experienced few tangible risks (Figure 1, letter "B"). If managers asked (a) to what extent are an individual's expectations about a disease and its effects met, and why, and (b) to what extent is the risk tangible to that individual, and why, they would learn that while most residents expected few risks to be associated with Lyme disease, they did so for different reasons. The managers would learn that even though some

residents encountered Lyme disease and ticks, risk perceptions and reactions were minimal because they looked for the disease "as due". Some residents highly valued natural processes in the local ecosystem. Other residents expected minimal risk because they were highly aware of personal protection measures. A third group of residents, however, expected few risks due to lack of awareness of the risk.

Differences in reasons for expectations at GGNRA could help risk managers at this NPS unit identify different communication needs for distinct audiences. While the risk managers might decide that no risk communication is needed for those who value natural processes and those aware of personal protection measures, the managers might target messages to communities or populations that demonstrate their expectations are based on a lack of awareness of Lyme disease risks.

Potential Applications of the FEAT

In general, a risk management entity could use the FEAT to assess and respond to lack of awareness or misinformation by evaluating expectations and tangibility in a population to determine whence the knowledge divide emanates (e.g., local cultural context, media coverage, prior direct personal experience with a similar risk that led to heuristic activation, etc.). The risk management entity could seek either to survey a representative sample of the public about which it is concerned (e.g., local residents and/or non-local visitors), or could ask key informants to report on conformance to expectations and perceptions of tangibility in a population. Because certain individuals regularly interact with the public on risk issues (e.g., local politicians, journalists, engaged community leaders, and heads of other locally-involved risk management agencies), these types of informants may be able to provide a proxy for the members of the public with whom they interrelate. Speaking with key informants may be the only realistic option when management decisions must be made with haste.

This option is not without drawbacks, however, as key informants could be misinformed or not be able to convey the whole picture.

If the risk management entity uncovers lack of awareness or misinformation as factors influencing risk perceptions, managers could then decide which would be more appropriate and/or easier, (a) to attempt to adjust *expectations* or (b) to endeavor to alter perceptions of *tangibility*. For example, a manager faced with people experiencing (a) high magnitude of risk associated with Lyme disease, due to them having no expectations of risk associated with disease or disease effects and (b) high perception of tangibility (due to observing many ticks), could seek to adjust expectations by trying to inform individuals of the ubiquitousness of the disease and vector. The manager could also mention personal protection measures. Alternatively, the manager might seek to alter perceptions of tangibility by allowing local communities to install devices that limit vector presence (e.g., 4-poster stations) or by directing natural resources staff to apply permethrin to particularly tick-infested areas.

Risk management entities might gain an initial awareness of management expectations and resultant risk perceptions from using the FEAT to assess expectations and tangibility, but in some situations, the managers may realize that without further dialogue between managers and stakeholders, they will reach an impasse. For example, local residents may contend certain management actions are necessary to reduce risk tangibility, but the risk managers may maintain that the requested actions are not possible (e.g., Lyme disease control at FINS). In such a case, the risk managers might need to engage the public in dialogue to determine whether the managers could take *any* action (communication or physical management) to help the public recalibrate their expectations to view the risk as a voluntary part of life. Such dialogical processes could help identify actions within the bounds of the risk management agency's policies that could alleviate concern, but that might not be

immediately obvious to the agency or community members outside of bidirectional conversation. A process of this sort could also increase community capacity and mutual trust, which could not hurt in making future risk communication about other risks more useful and accessible to the public.

The FEAT encourages risk management entities to gather sufficient initial information for responding to a risk by examining only two major themes. Investigating (a) the extent to which an individual's expectations are met about disease and disease effects, and why, and (b) the extent to which the risk is tangible to that individual, and why, would reveal to a risk management entity a number of factors important to risk perceptions. Managers could then use Table 4 to determine how these component factors amplify or attenuate risk perceptions.

Future Research

The Framework of Expectations and Tangibility (FEAT) is an emergent theoretical proposition, and while this framework is potentially useful to managers, it requires further development. Perhaps the most useful investigation would examine the FEAT's *credibility* (often referred to as internal validity in quantitative research). Does the FEAT accurately characterize magnitudes of risk perceptions across all the full spectrum of conformance to expectations and perceptions of tangibility? The FEAT was conceptualized using emergent relationships, but these relationships did not cover the gamut of possible interactions between expectations and tangibility. Future studies may be able use the FEAT to assess risk perceptions of threats that (a) do not conform to expectations and are not perceived as tangible or (b) that moderately conform to expectations and are perceived as moderately tangible.

Second, additional research could appraise the degree to which the FEAT is pragmatically *useful* by assessing risk perceptions through expectations and tangibility and then evaluating the extent to which this knowledge was able to inform selection of

content and/or audiences for risk communication. The evaluation could also examine the degree to which the FEAT (a) captured expectations for risk management and/or (b) alerted an agency to risks associated with a risk object of which the agency was theretofore unaware.

Finally, further inquiry could examine the degree to which the framework is *transferable* to other risks and unique social, cultural, and environmental/geographic contexts. As discussed in chapter six, nothing about the FEAT theoretically links this framework exclusively to wildlife and vector-borne disease risks. Analysis of empirical data on perceptions about these risks allowed the framework to emerge.

Conclusion

Knowledge of the public's risk perceptions and reactions could help managers respond to risks with effective communication and/or other management actions. Understanding the magnitude and types of risks about which individuals are concerned could aid managers in creating messages tailored to specific audiences to address lack of awareness or misinformation about a risk. This awareness could also alert an agency to risks of which the agency is ignorant and provide managers with information about specific actions that the public views as important for risk management.

The data analysis, reported in chapter five, identified twenty individual factors that influence risk perceptions and reactions. Table 4 offers managers a tool for quickly assessing some basic effects of individual factors on risk perceptions. Certain factors listed in this table (e.g., those that are connected strongly to objective constructs) are more useful for rapid assessment of a population's risk perceptions than others are (e.g., those relating to purely mental constructs).

The FEAT offers a potentially useful means for assessing the cumulative effect of multiple factors on risk perceptions and reactions. A manager could use Figure 1,

along with an incipient understanding of a disease's conformance to a population's expectations and the population's perceptions of tangibility, to determine how to begin to communicate about a risk. Future research is needed to establish the theoretical credibility and usefulness of this framework as well as its transferability to risks and contexts beyond those associated with wildlife and vector-borne diseases in and around NPS units.

Chapter Eight: Reflections

"Where lies the final harbour, whence we unmoor no more?"

-- Herman Melville (1819-1891), *Moby Dick*

The data have been collected, the analysis completed, and the findings reported. In these final pages, I reflect on the research project in which I invested two years of my life and I begin to envision the future intimated by the analysis and discussion in the foregoing chapters.

After working with Cornell professors and wildlife disease professionals at the NPS to identify a theoretically and pragmatically interesting research question, the next stage of this thesis research was selection of methodology, research design, and specific methods. I cannot thank my mentors and colleagues enough for introducing me to and encouraging me to undertake a case study approach that relied on intensive oral history interviews for collecting exploratory data. One likely reason for the limited focus of most studies that examine risk perceptions of wildlife diseases is that extremely few studies in the field have relied on exploratory data to characterize risk perceptions and reactions. No research of which I am aware has employed a multi-case study approach for gathering such data, even though, as Yin (2009) points out, this approach is ideally suited to answering "how and why" questions about contemporary issues in real contexts.

The exploratory data gathered through my multi-case study research suggests that research on risk perceptions and reactions (about wildlife diseases, but also in general) has a long way to go before the researchers in this field have a comprehensive understanding of how various factors affect (e.g., amplify and attenuate) risk perceptions and reactions. The one piece of research reported here identified three

novel factors and suggested a new framework for explaining how these factors function in concert, indicating that research on risk perceptions and risk reactions is not close to the point of saturation. Further studies may reveal additional factors and suggest other frameworks. Using the factors and/or framework that emerged from this research could be one point of departure for future research, but I also see great value in the design and execution of additional exploratory case study research.

As for my own intentions for future research, consistent with recommendations from chapters six and seven, I aim to operationalize and test the ability of *expectations* and *tangibility* to assess risk perceptions about wildlife disease in and near NPS units. I wish to create and evaluate risk communication based on these findings. Evaluation of the risk communication would provide data on the credibility and pragmatic usefulness of the FEAT.

One of the most difficult tasks in my future investigation will be to identify appropriate contexts for research. Selection of the four cases in this study took six to seven months and involved an intensive vetting process. The project team sought to pick cases that could best highlight how people perceived and reacted to risks associated with wildlife diseases. Despite our intentions and careful selections, in two of the cases (GGNRA and WSEPP) the population of concern, in aggregate, did not perceive the diseases as posing virtually any tangible risks. Even some sub-populations in the other two cases (SBDNL and FINS) did not perceive tangible risks associated with the diseases. Thus, in cases where I believed risks associated with wildlife diseases would be most prevalent in the public consciousness, few people perceived the risks as "risky."

Across the four case studies, the factors that emerged as affecting risk perceptions and reactions more often than not functioned to attenuate, rather than amplify risks. In future research that seeks to gather data about *visitor* risk perceptions

and reactions, investigators may have even greater difficulty in identifying tangible risks, because visitors to NPS units are not necessarily tied to the location in which the risks are experienced. In GGNRA and particularly in WSEPP, even when I spoke with local residents, who lived in the context where the wildlife disease risks were supposedly relevant, the conversations often returned to risks unconnected to disease.

The foregoing reflections portend a couple implications. First, NPS managers who find the FEAT and/or the relationships specified in Table 4 useful will likely identify nil to low magnitudes of risk perception in many cases. This knowledge is still valuable in that it reveals that risk communication may not always be necessary, and that perceived risks are not likely to lead to negative collateral effects. The understanding, however, also leaves an unanswered question – if wildlife disease is not a salient concern, then what is, and how does that concern affect the NPS unit?

Another implication of a lack of public focus on disease risk was mentioned previously – studying risk perceptions and reactions in NPS units may be difficult. Table 4 provides suggestions for how to find a tangible risk. Perhaps I can identify a newly-emergent disease related to values and activities that is not perceived as ubiquitous or voluntary, has high visibility, proximity, and probability of being experienced, affects quality of life and is noticed through direct personal experience. Concerns about management actions and heavy media coverage of the disease are not liable to hurt tangibility either. Even a disease with most of these characteristics may garner enough attention in the public consciousness to serve as a revealing focus for research on *expectations* and *tangibility*. Another research option, if such a disease cannot be found, would be to study disease risks in multiple cases along with risk perceptions and reactions relating to the more publicly salient environmental (non-disease) risks in each case. A comparison of the risks within a case could not only speak to the credibility of the FEAT, but also to its transferability.

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